The Electrical Industry's Weekly Magazine

January 28, 1957

Electrical World

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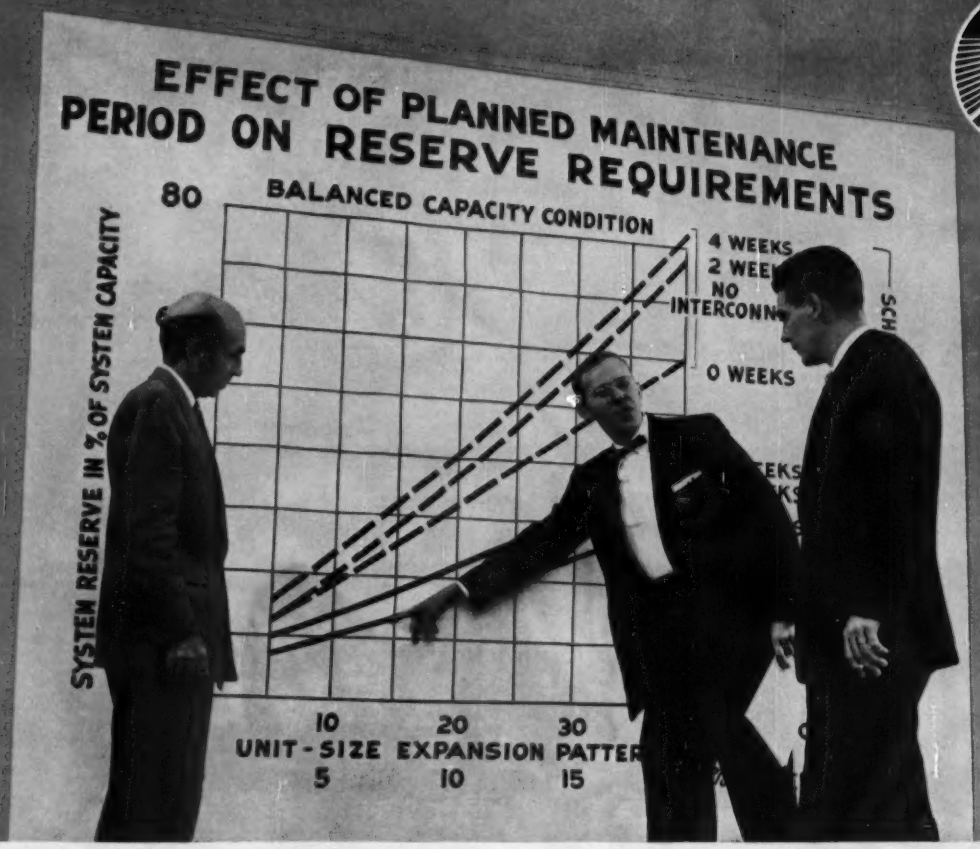
ELECTRICAL INDUSTRY STATISTICS

53rd Annual Report on the Electrical Industry

...Page 115

At AIEE: Adams Gets Edison Medal . . . Page 100



RESERVE REQUIREMENTS are affected by the required maintenance period. In the case of interconnected areas, the effect of time out for maintenance is reduced. Authors of General Electric study, A. G. Mellor, L. K. Kirchmayer, H. O. Simmons, Jr., examine a graph showing this effect.

Greater generation economies possible through planned system interconnection

Probability studies indicate that integration of areas plus choice of optimum unit size help cut expansion costs

In order to meet its fundamental obligation to supply power with a high degree of reliability, an electric utility must have reserve generating capacity available. But, the question often arises: How much reserve should and can be maintained economically to sustain reliability? The larger the unit, the larger the reserve capacity needed. However, there may be additional dollar per kw gain when larger machines are used. These opposing factors serve as a basis for establishing the most economic generation expansion pattern.

A recent General Electric study goes a step further by considering, as have many utility system planners, the conditions that would exist if two presently independent but neighboring utilities were interconnected to operate as one area. It was found that since there is a diversity of forced outages between the two areas, proper integration permits each of the areas to operate with less reserve than would previously be required.

LOWER COSTS

As a result of this study on planned system interconnection, General Electric engineers have arrived at a method of analyzing the problems that exist to obtain factual answers. These methods can be applied to many systems. For example, in a typical system studied, when adequate interconnection was made between areas and the optimum expansion patterns selected, savings on the order of 15–20% could be achieved.

VITAL IN THE FUTURE

It is estimated that unit sizes of 600,000 kw or larger will be economically utilized on some power systems within the next ten years. Adequate system interconnection will enable even the relatively small utility to take advantage of the larger units and thus realize economies—economies now available only on larger interconnected power systems. These economies will benefit all utilities by stimulating load growth throughout the industry. For more information write for GER-1312, "The Effect of Interconnection on Economic Generation Expansion Patterns," General Electric Company, Section 301-343, Schenectady 5, N. Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 147, No. 4 JAN. 28, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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New Fuel Successfully Tested
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Special Report

53rd Annual Report on the Electrical Industry
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This underground network vault with its array of cables is typical of the up-to-date installations demanded by Pacific Gas and Electric Company in order to render maximum continuity of service to their customers.

Dependable service below pays off above

Pacific Gas and Electric Company's recent installation of nearly seven miles of Keystone butyl-insulated duct cable is just one part of its continuing network expansion to insure dependable power for San Francisco's ever-increasing loads.

Meeting the rigid RO & N specifications set up by Pacific Gas and Electric Company engineers, Keystone butyl-insulated cables offer extra value in their high dielectric strength, moisture resistance, resistance to ozone and corona cutting, and in their ability to take sharp bends and withstand high conductor temperatures. Insulation and sheath are vulcanized together in a construction that withstands the moisture and heat in duct systems and allows simple, damage-free pulling.

Backed by Okonite research and quality control, Keystone butyl-insulated cables offer these service-lengthening features without any increase in cost.

Keystone is one of the family of Okonite insulations: Okolite and Okonex (strip-insulated types), Keystone and Watertite (extruded types). Bulletins are available on each from The Okonite Company, Passaic, N. J.

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where there's electrical power . . . there's **OKONITE CABLE**

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. . . *from the publisher*

Again in this issue Electrical World presents its annual "State of the Industry" Statistical Report. The first appeared on Jan. 2, 1904. It amounted to nothing more than a column on the editorial page listing sales figures for various electrical equipment items, (ie, dynamos, arc and incandescent lamps, annunciators, lightning arresters, etc.).

This year's statistics spread over 48 full pages. They cover everything from output and power use totals by type of customer, to sales of electric appliances, and industry construction budgets.

Our market research staff, headed by Art Stegeman, started last September to accumulate this data. Since then the staff has put more than 2,500 manhours into assembling and compiling it.

Questionnaires were sent to some 3,361 American power suppliers (including U. S. possessions) plus 529 in Canada. With return of the material came the job of checking and correlating it with Edison Electric Institute, the Federal Power Commission, and other sources. Stegeman estimates his group made upwards of 150,000 separate calculations, used 500 feet of adding machine tape.

We are indebted to these power suppliers for their cheerful assistance in supplying data for their systems. But for their help, such overall industry information would not be possible.

Fischer Black

ELECTRICAL WORLD

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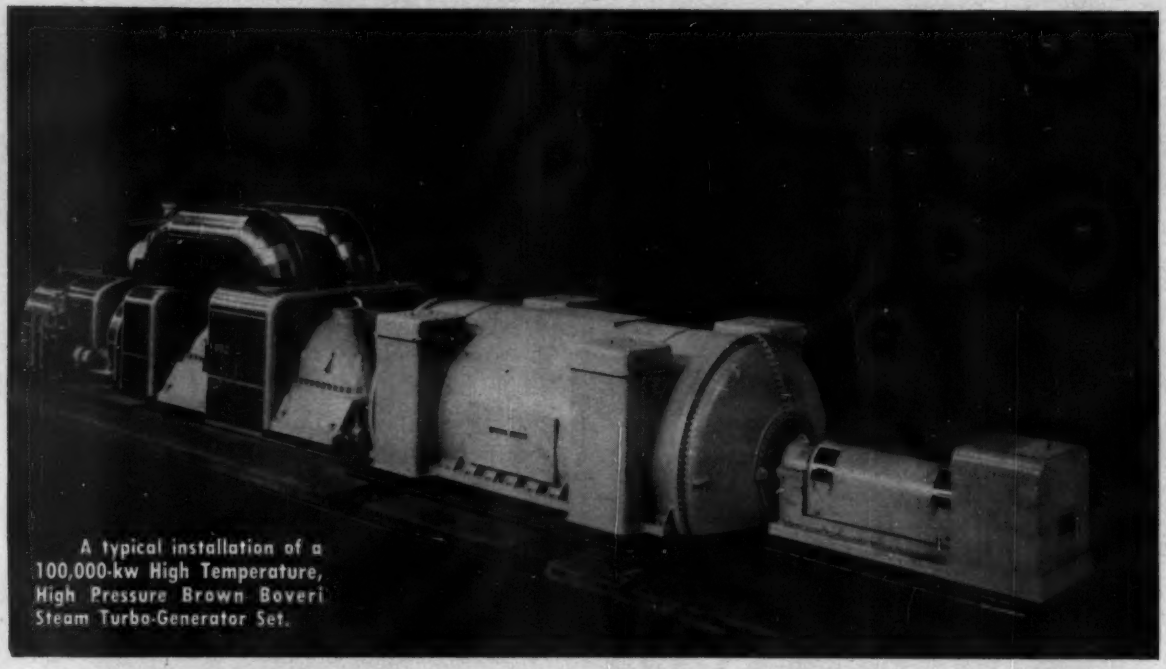

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Pull-up blocks and dowel blocks, shown above, are used to simplify alignment during installation.

Size alone dictated that this huge 115,000-square-foot condenser for The Detroit Edison Company's River Rouge Station be fabricated and shipped in sections. Here's the way this job was handled:

Before shipment, matching joints were machine scarfed for full penetration welds, and sections were carefully fitted together. Each joint was then equipped with "dowel blocks" and "pull-up blocks" as shown in the inset.

The condenser was then disassembled and shipped.

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Giant 115,000-square-foot condenser of new River Rouge Station.

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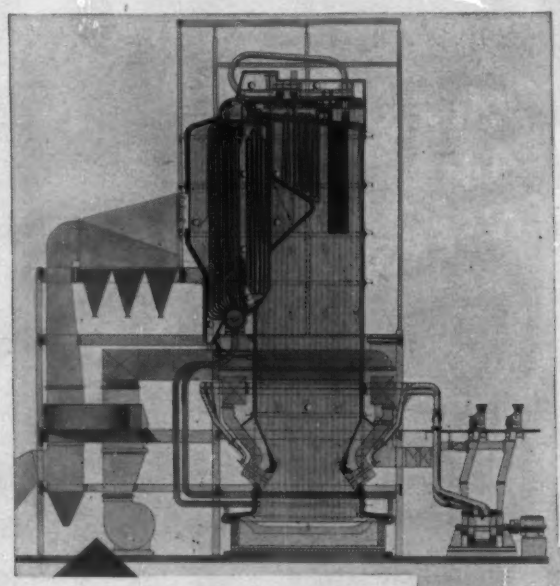

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Delaware Power and Light Co. will burn the Fluid Coke from the new Tidewater Oil Flying "A" Refinery in three 500,000 lbs/hr Riley TURBO FURNACE Units. Refinery Gas, Oil, Coal will be standby fuels. C. F. Braun & Co., Engineers and Contractors

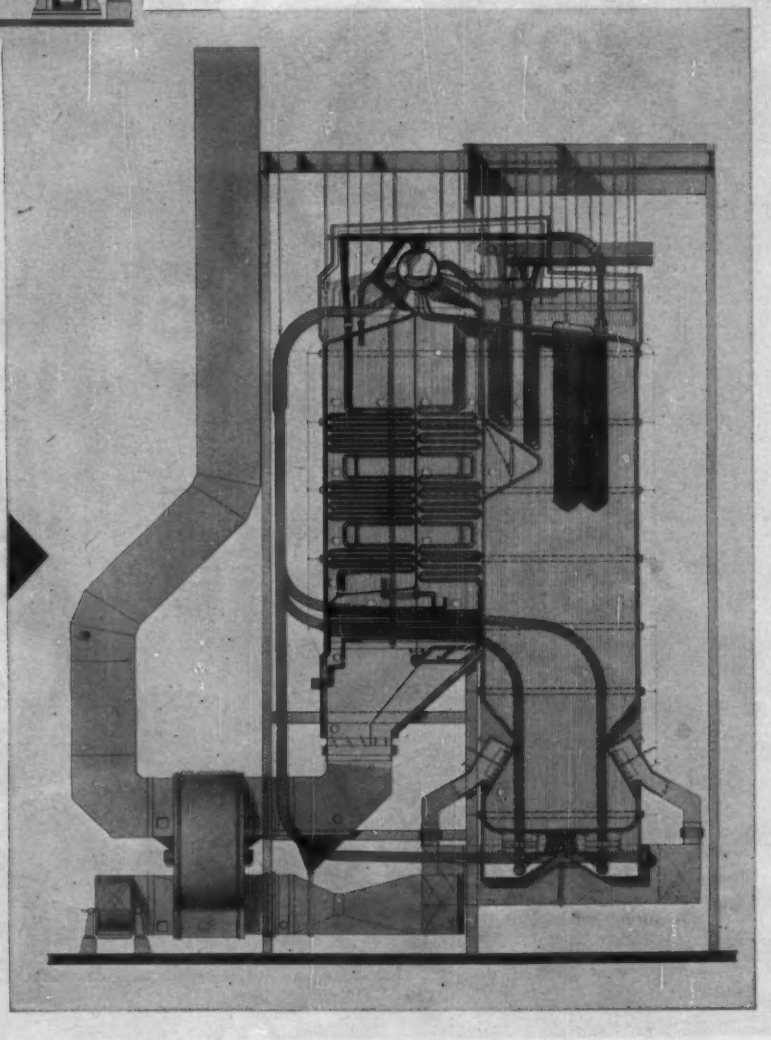
* *Fluid Coke*, is an extremely hard almost pure carbon by-product of the most recent development in catalytic cracking *to burn effectively*. It needs a furnace that provides high heat concentration after being reduced to required fineness by special Riley Pulverizers.

★ ★ ★

Louisiana Power and Light Co. will burn natural gas in its 1,550,000 lbs/hr Riley Reheat TURBO FURNACE Unit—it can quickly utilize oil, coal, lignite, refinery coke when economically justified.
Ebasco Services, Inc., Engineers

★ ★ ★

The TURBO FURNACE is enjoying rapid acceptance. It was formally introduced in the Fall of 1955 following extensive operation of actual installations that thoroughly established Riley's claims for its performance and design. Since then, thirteen TURBO FURNACE units have been sold to public utilities and large industrial companies. The total steaming capacity of these thirteen boilers exceeds 8,000,000 lbs/hr.



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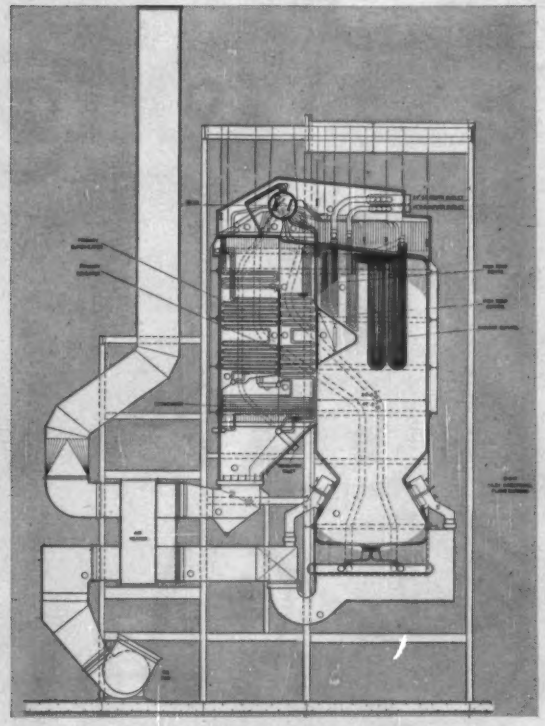
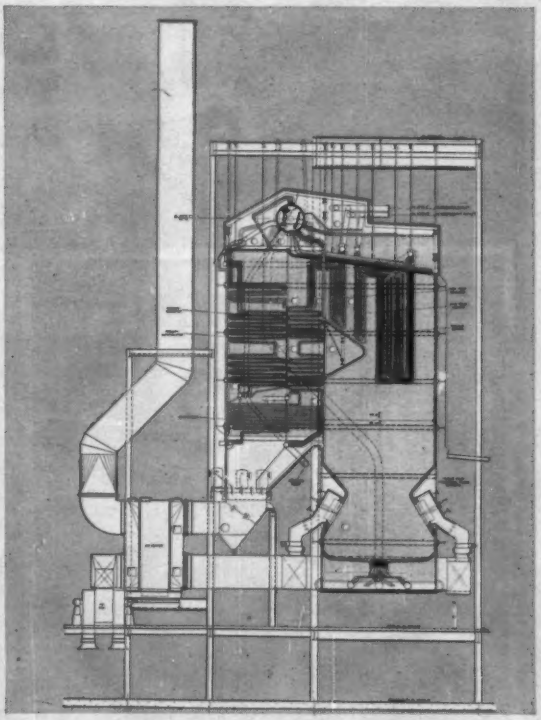


Dallas Power & Light Company will burn natural gas and oil. Texas Lignite in the future in this 1,250,000 lbs/hr Reheat Unit. Ebasco Services, Inc., Engineers.



Texas Electric Service Co. will burn natural gas and oil in this 825,000 lbs/hr Reheat Unit. It can quickly convert to pulverized coal. Ebasco Services, Inc., Engineers.

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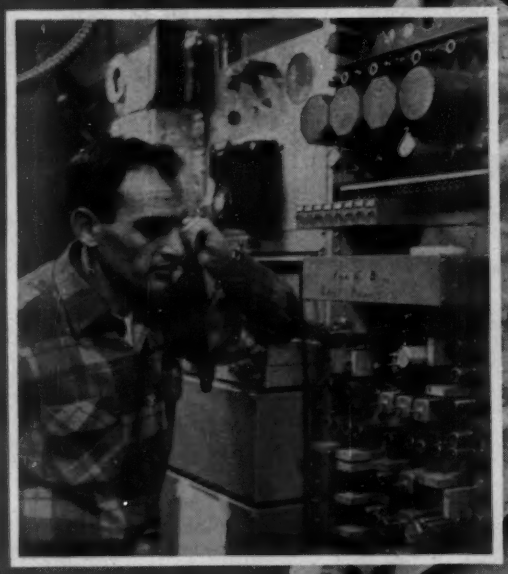

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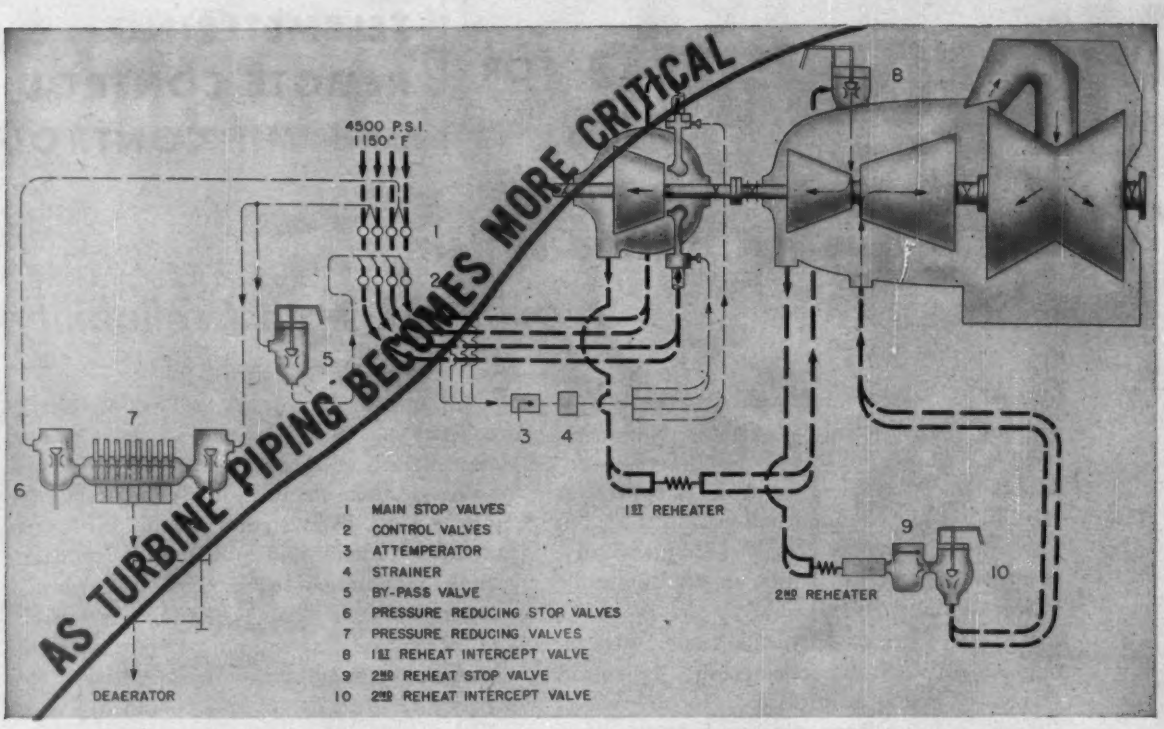

Schematic steam-flow diagram of the General Electric 125,000-kw turbine-generator unit at Ohio Power Company's Philo plant

Kellogg Engineering and Fabrication Keep Pace

The General Electric 4,500 psi, 1,150 F steam turbine at Ohio Power Company's Philo plant is a major advance in high pressure-high temperature design. Piping on the turbine typifies M. W. Kellogg's service to power generating equipment manufacturers and to the electric-utility industry.

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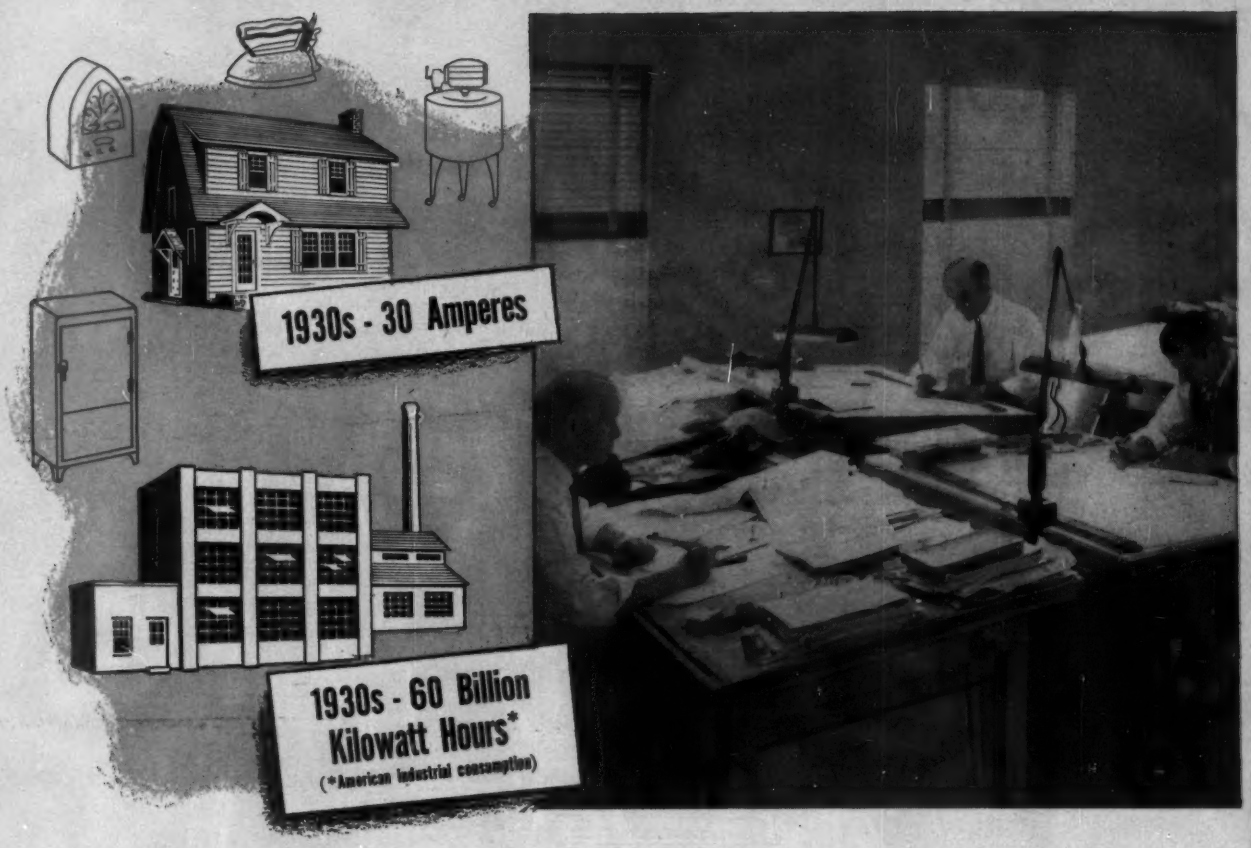

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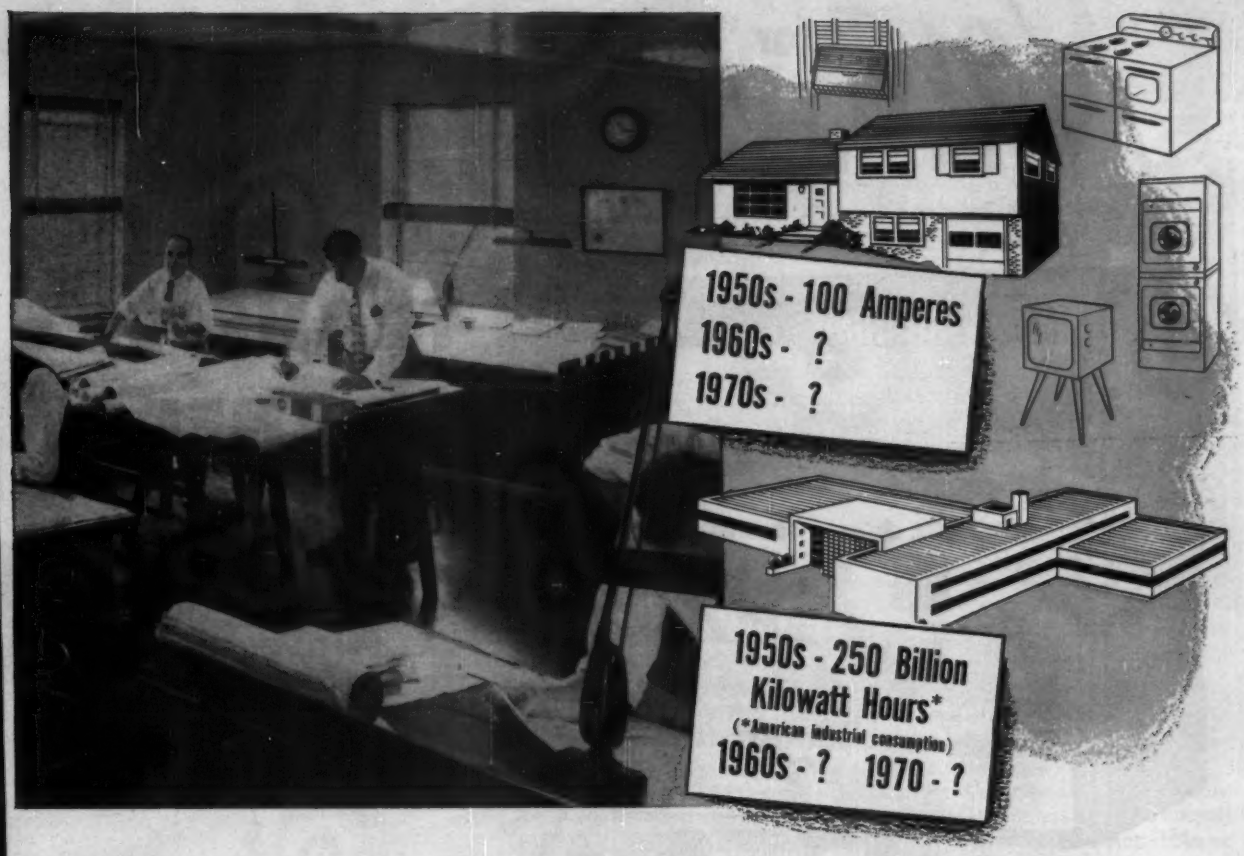

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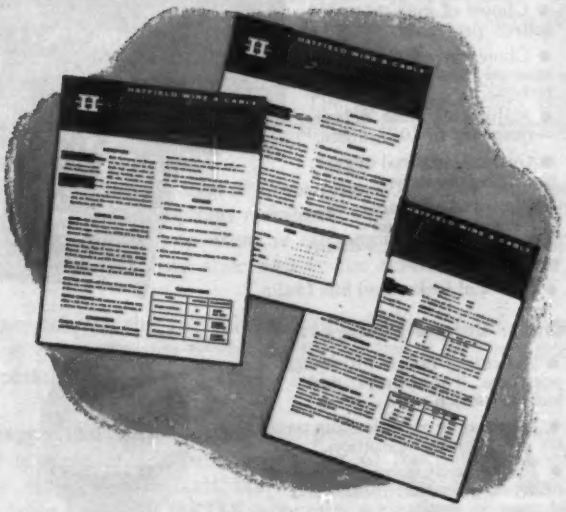

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NEWS-SCOPE

FUTURE NEWS ▶

Electric utilities are holding to major plant expansion schedules despite the tight money situation. An EW check among a number of companies confirms this. If cutbacks do come it'll be because of raw material shortages—not lack of ready cash.

Congress may make final decision on the $225-million Trinity River project controversy. This would follow a report of Interior Secretary Fred Seaton to Congress around Feb. 12. He will avoid an outright recommendation on Pacific Gas & Electric Co's bid to buy the falling water from the dam and develop and market the power. Rather, he will point out advantages and disadvantages of both private and public development of the project and dump the final decision into the lap of Congress.

LATE NEWS ▶

Three newly formed insurance syndicates will soon provide basic coverage of up to $60 million against liability and personal property damage for each of the nation's nuclear facilities. Two of the groups—Nuclear Energy Liability Insurance Assn and Nuclear Energy Property Insurance Assn—have been formally established. The third is now nearing completion.

Interior has formally asked FPC to increase the rates of the Arkansas P&L-Reynolds Metal 30-year pact approved in 1952. Interior's brief claims pact provisions are not binding because: 1) the contract discriminates against public bodies and co-ops because of its lower rates; and 2) the contract fails to comply with sound business principles as established in the Flood Control Act. Interior wants rates raised from present 5.2 mills to 8.25 mills.

Securities and Exchange Commission has ruled that Power Reactor Development Co is not an electric utility. The ruling, which exempts the 21-company group from the holding company act, was made independent of the AEC hearings now testing the safety of PRDC's proposed reactor near Detroit. (See p 103.)

AEC's experimental boiling water reactor at Argonne National Laboratory will go into continuous full power operation Feb. 9. The 5,000-kw facility is the first reactor system designed solely for experimentation in power generation.

A bill to abolish Washington State's Power Commission has been introduced in the state legislature by several Democrat members. Gov Albert D. Rosellini had previously asked the lawmakers to examine the possibility of transferring the commission's functions to another state agency for economy reasons.

Four of the 13 generators at the partially restored section 3A of Niagara Mohawk's Schoellkopf plant are now producing 32,000 kw of 60-cycle power on 24-hour-a-day operation.

Japan's Atomic Energy Commission has been advised to buy a reactor of the British Calder Hall type by Ichiro Ishikawa, leader of the nation's nuclear energy mission that visited Britain last fall. Decision whether to buy the nation's first reactor from Britain or the U.S. now rests with the Japanese AEC.

Kuhn, Loeb & Co wins $10 million first mtge 4½% bonds (Aa) due 1987 of Atlantic City Electric Co with a bid of 101.11%; reoffers at 101.656% to yield 4.40%. Issue is going "very well with over 75% taken in first half hour." (See p 221.)

Live Better . . . Electrically will open its 1957 program on Jan. 30 with its second annual closed circuit telecast, which will be piped to more than 60 cities.

ELECTRICAL WEEK

A TWO-MINUTE

INDUSTRY STATISTICS ▶ **Electric utilities have budgeted a record $4.8 billion** for capital expenditures this year—up an impressive 28% above last year. Generation will account for $2.2 billion this year—up 51% over last year. Transmission will account for $779 million—up 30%. And distribution will account for $1.6 billion—up 6.6%. Miscellaneous expenditures are slated to hit $208 million—up 12% over last year (p 115).

Output for the year was 601,441,726,000 kwhr (p 137) . . . This production figure was magic for R. H. Goodrich, Indianapolis P&L, making him load forecasting champion for the year (p 102) . . . Overall, utilities added 1.44 million new customers to bring the total to 54 million customers. Energy sales jumped 10% to hit 529 billion kwhr.

Electric companies set a number of financial records. Gross revenues hit $7.5 billion to enable net income to climb 8% to $1.357 billion. But operating expenses went up 9%, edging up the operating ratio from 44.3% in 1955 to 44.4% in 1956. Only eight known rate increases totaling $6.7 million were approved during the year (p 128).

These are but a few of the key figures from the 53rd annual industry statistics report beginning on page 115. The report brings you the most comprehensive and authoritative statistical review of electric utility activities in 1956 now available.

EVENTS ▶ **At AIEE winter meeting:** Pres M. S. Coover urges closing gap between high school preparation and college entrance requirements . . . Dr Comfort A. Adams, oldest living past president, receives 1956 Edison Medal for pioneering achievements in development of alternating current machinery and electric welding . . . Keynote Speaker F. B. Kappel says engineers must keep pace with technological progress and, with industry's aid, strive to fill their broader industry responsibilities (p 100) . . . W. J. Barrett to be next AIEE president (p 102).

Connecticut turnpike will get 53 miles of continuous lighting to provide safer night driving conditions. Mercury vapor units will be staggered 100 ft apart (p 106).

WASHINGTON ▶ **Interior Secretary Fred Seaton will ask Federal Power Commission to delay** action on Pacific Northwest Power Co's applications for licenses for the Pleasant Valley and Mountain Sheep hydro projects on Snake River. Seaton wants more time to gather information on a higher federal Pleasant Valley development, which he may offer as an alternative to the company plan. But this action still doesn't please federal power advocates (p 103).

GENERATION ▶ **Fluid (petroleum) coke has proved satisfactory as a fuel** in utility-sized steam stations, but don't look for it to make much of a dent in the overall fuel market. It'll be mainly for those stations in the immediate vicinity of oil refineries which produce the coke. You'll find analyses of varying forms of the coke, comparisons with regular coke and coal, and test data on utility experience with the fuel in the comprehensive article written by Darcy Curwen (p 112).

Completely redesigned "no-coal alarm" is proving its dependability in the coal boxes of Units 4 and 5 at Ohio Edison's Philo Plant. Innovation is an actuator consisting of a paddle arm which throws a mercury switch (p 168).

TRANSMISSION ▶ **Before construction men laid the 2.3 mile, 15-kv submarine cable** between St. Thomas and St. John in the Virgin Islands, they checked their calculations

with a novel measuring tape. Skin divers also gave them a hand on the job. Author E. P. Eardley tells the story as if he enjoyed the experience (p 110).

Woodpeckers love that 60-cycle hum. To accommodate them and keep them from gouging into new transmission poles, crewmen at Oklahoma Public Service now bolt a section of old pole right up near the cross-arms of the new poles. That way woodpeckers get the hum and peck at the old pole (p 168).

DISTRIBUTION ▶ **Sturdier brackets for mounting a cutout and lightning arrester on poles** and crossarms have been developed by Florida Power Corp. Tests indicate the new brackets can withstand recoils from higher fault currents of 12-kv distribution with no apparent damage to the bracket or the crossarm to which it is attached. It's said to be cheaper than old brackets and to conserve inventory space (p 167).

SELLING ▶ **Special "night valley" rate for controlled water heater** use is gaining acceptance on Wisconsin P&L lines. It provides a 9-hour daily charging period at 75¢ a month plus 7.5 mills per kwhr. That compares with the regular controlled water heating rate for 17 hours of charging daily of 75¢ a month plus 1.1¢ per kwhr. Problem is to make sure the individual customer's requirements fit the service limits of the new rate and that sufficient storage capacity is provided. Authors M. W. Freck and R. A. Mendenwald report that Wisconsin P&L have picked up 504 customers under the new rate since it was first offered early last year (p 174).

MANAGEMENT ▶ **Utility securities offerings continue heavy** with interest rates running above 4½% (p 221) . . . And Electrical Business Outlook says Federal Reserve Board is shifting its credit policy into neutral. There won't be much further tightening of the money market by FRB pressure, but there won't be much relaxation of pressures either (p 219).

Regulatory legislation is introduced in New York, California, and Vermont . . . Tallahassee City Council boosts municipal electric rates 3% to compensate for rising fuel oil prices . . . Union Electric Co sets up centralized group for handling customer service calls. Some 90% of calls are handled by this one-stop service . . . Key employee stock purchase plan approved for Cleveland Electric Illuminating Co (p 219).

PEOPLE ▶ **Columbus & Southern Ohio Electric Co elects H. V. Potts** vice president in charge of employee relations . . . Norman C. Storck is new chief electrical engineer at the Wisconsin Electric Power Co (p 210).

MANUFACTURERS ▶ **Method for putting aluminum coating on steel pole hardware,** reported to be practical and inexpensive, has been developed. Present facilities limit size of items to be coated to 38 inches (p 203) . . . Two 2,500-hp, 600-rpm, weather-protected, induced draft fan motors have been shipped to Detroit Edison (p 203) . . . Six 200,000-kva, single-phase autotransformers to step voltage up and down between 345 kv and 230 kv have been shipped to BPA (p 204).

NEW EQUIPMENT ▶ **Recent addition to a watthour meter line is a network,** polyphase unit available in class 100 and class 200 ratings. Magnetic suspension is said to eliminate bearing replacement and reduce tilt error revenue losses. Full load speed is 8.33 rpm (p 187) . . . Several models of a corrosometer said to measure metal corrosion directly in increments as low as 01. micro-inch are now available. The measurement compares the electrical resistance of exposed and protected specimens of a test metal independent of temperature (p 187).

ENGINEERING TRENDS

Forced-oil cooled transformers show savings of $10,000 to $15,000 in economic evaluations even for the smallest available ratings. Says GE's L. H. Hill: "We have yet to find a utility application of 20 Mva or more where economics do not favor forced oil."

Metallic corrosion costs Britain $1.7 billion annually and indirect costs boost this by an incalculable amount, Dr W. M. J. Vernon told the Institution of Civil Engineers recently at London. He warned that coupling dissimilar metals is the most common error, urged greater consideration of corrosion control costs in design and operation.

Aluminum plates collect cavitation data when attached to hydraulic turbine runners. These plates are not eroded, but dents in them reveal the severity of water action. Velocity has been found the controlling factor.

Valve and pump seals for the PWR's high-purity water system pose difficult materials problems which are aggravated by radiation-induced corrosion and fouling. Lithium hydroxide and dissolved hydrogen are the most promising inhibitors.

Precipitation by electrostatic means of dust from air is most difficult for particles of 0.1 to 0.2 micron radius.

FROM EDITORS IN THE FIELD

Load pickup from 5% to full load in 3 sec to carry nearby loads when transmission ties are lost is a special requirement for new 50-Mw unit at Pacific G&E's Humboldt Bay Station. Auxiliaries will have to operate with 35% voltage drop and 10% speed drop until equilibrium is reestablished after a sudden pickup.

Other changes anticipated by Pacific G&E Co, according to Vice President J. K. Norton, include: Converting most hydro plants to automatic or remote operation, use of 440-kv for transmission and bundled conductors on 220-kv lines, automatic economic dispatch which includes evaluation of steam plant and hydro efficiencies and water in storage.

Coal factor is now computed continuously and printed on tape by a recorder at Cleveland Electric Illuminating's Lake Shore Station. Experience shows improvement in plant operation and load dispatching, points way to future coal computer.

More major steam plants near the coal fields should be anticipated as the utilities' counter to rail rate boosts. EHV-transmission will expand as the economical means of carrying their output to load centers heretofore dependent upon coal by rail. The changing economic picture will put new emphasis on joint power developments by interconnected utilities.

Racks are designed for a minimum space requirement and can be passed through a 30"-diameter manhole.

Submersible equipments...

L-M's New Secondary Network Capacitors Increase Capacity, Improve Voltage

Line Material's new 216 volt, 13⅓ kvar submersible capacitor equipments can be your answer to heavier network loading. Secondary capacitors will improve the low power factor of heavy motor loads, such as air conditioning. This substantially reduces loading on conductors and transformers, and helps to improve low voltage conditions. Capacitor units can be installed more quickly and at much less cost than system changes, such as larger transformers, cables and additional vaults.

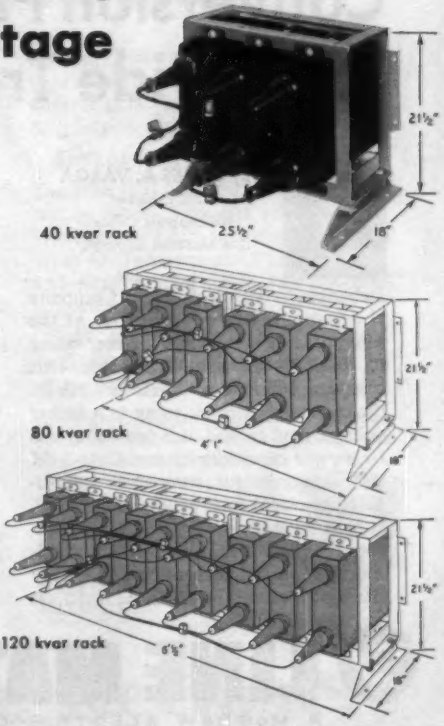
L-M's new secondary capacitors have outstanding product features such as aluminum metallic coating under a primer and finish coat of alkyd resin paint, strong solder-sealed bushings, and low-temperature Elemex liquid dielectric. Each unit is equipped with one terminal mounted current limiting fuse; bushings are enclosed in water-tight covers.

Capacitor Racks

Capacitor units are available in 40, 80, and 120 kvar racks, entirely assembled at the factory and ready for installation in the field. Racks can be stacked or mounted on floor, wall, or ceiling in many arrangements to fit vault space. Ambient temperature limits are 55° C. for single-tier equipments and 40° C. for two- or three-tier equipments.

Get Complete Information

Ask the L-M Field Engineer for information on features, design, and delivery on L-M's new secondary network capacitors and capacitor equipments. Or write Line Material Company, Milwaukee 1, Wisconsin



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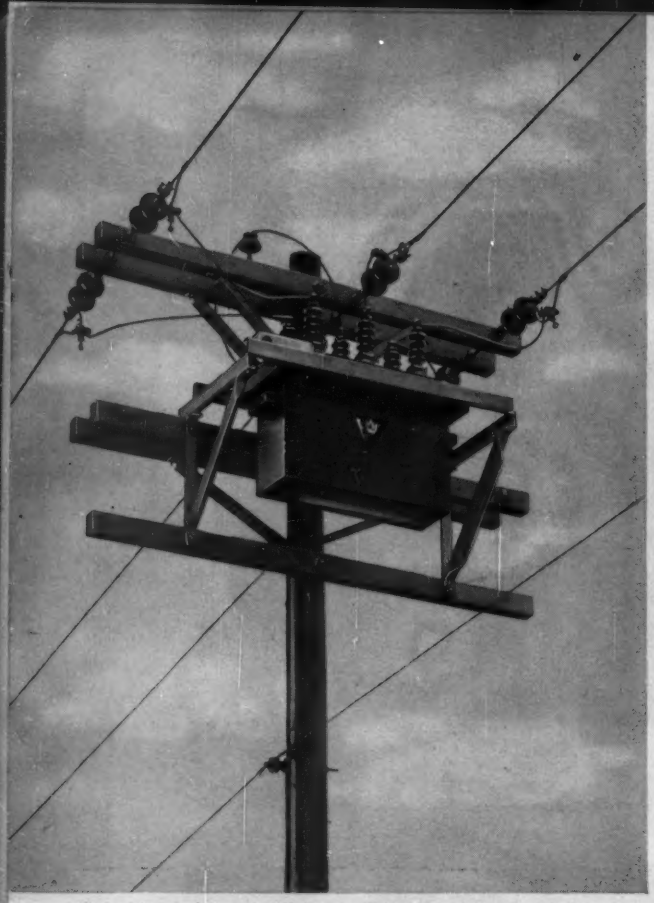
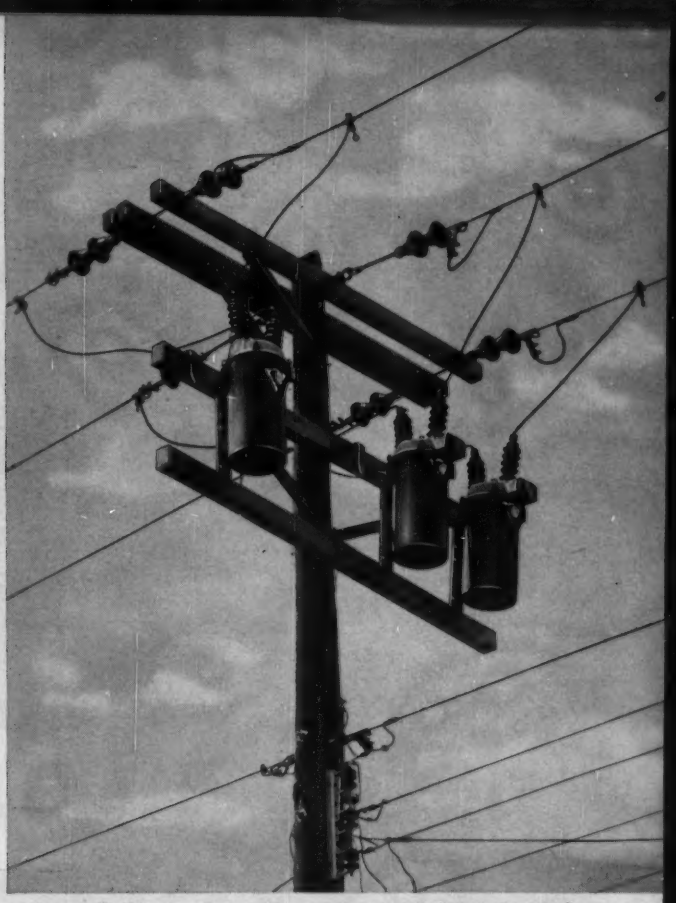
Elemex® Capacitors



One of four pole-mounted Kyle type R three-phase reclosers that were installed in the initial area converted to 13 kv. The type R provides simultaneous 3-phase fault protection and fully coordinates with other types of Kyle sectionalizing equipment and with branch line fuses.



One of 13 Kyle type L single-phase recloser installations in the initial area converted to 13 kv. The installations involved over 2100 customers and protected 155 miles of line. Trees and animals were the primary hazards affecting operation of the distribution feeders.

Utility converts fringe area to 13 kv distribution system . . .

Conversion Plans Include Kyle Reclosers To Provide Transient Fault Protection

By **JAMES A. VARGA**
Field Engineer
Indianapolis Office
Line Material Company

Indianapolis Power & Light Company is accomplishing two objectives at the same time in their plans for converting to a 13 kv distribution system. This company is able to *serve heavier loads* on the existing system by going to a higher voltage. And second, it is providing *better service continuity* by installing L-M Kyle reclosers for completely coordinated transient fault protection.

L-M Kyle reclosers provide the high-speed circuit clearing (2-cycles maximum) required to reduce conductor burndown caused by transient faults. It is possible to clear up to 90% of transient faults and reduce permanent faults with Kyle reclosers.

All L-M Kyle reclosers can be coordinated in series by selection of coil size or sequence. They are completely automatic and self-contained, with operating sequences accurately controlled by the hydraulic timing mechanism.

Single- and Three-Phase Reclosers

The Kyle type L single-phase and type R three-phase reclosers are rugged, power-class reclosers designed for pole mounting or in substations. They offer the widest choice of time current characteristics—fast, retarded, and extra-retarded, with four operations to lockout in any of seven sequences. The ratings range from 25 to 400 amperes, with up to 100,000 kva fault capacity. Almost any supplementary relaying scheme is adaptable to the type R recloser for substation application. These include ground tripping, shunt tripping, shunt lockout, and auxiliary switches for remote-control indication, low-voltage control switching, or metering.

Get the Whole Story on L-M's Kyle Reclosers and Sectionalizers

Ask your L-M Field Engineer for information and bulletins on Kyle apparatus and complete coordination—single- and three-phase—from substation to load. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

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LINE MATERIAL Kyle® Reclosers

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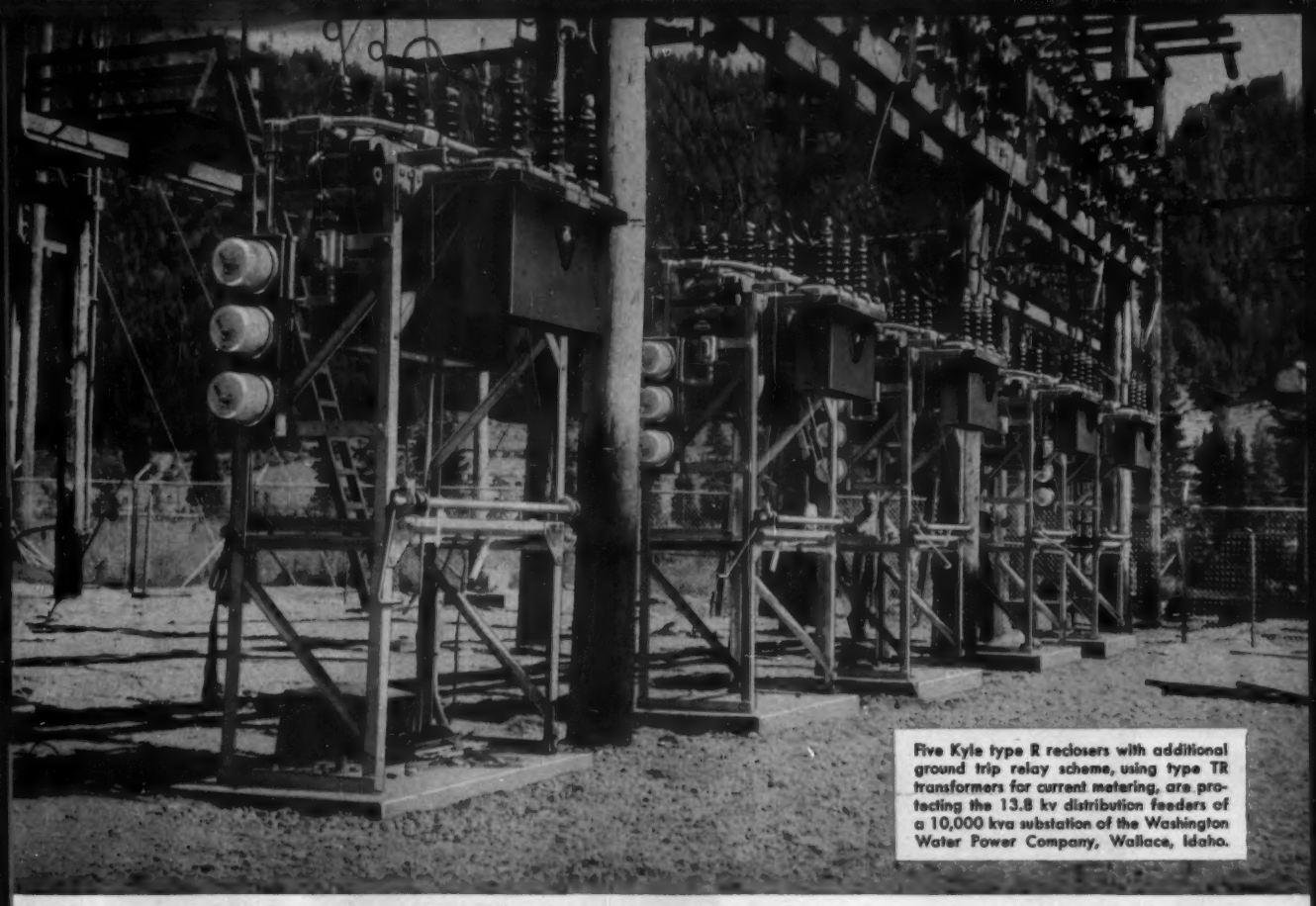

Five Kyle type R reclosers with additional ground trip relay scheme, using type TR transformers for current metering, are protecting the 13.8 kv distribution feeders of a 10,000 kva substation of the Washington Water Power Company, Wallace, Idaho.

Up To 90% Of Transient Faults Cleared . . .

High-Speed Kyle Type R Reclosers Help Improve Service Continuity

by **R. L. LEMMAN**
Apparatus Engineer
Line Material Company

L-M Kyle reclosers provide high-speed (2-cycle maximum) clearing of faults on the distribution system. This minimizes permanent system faults resulting from transient or non-persistent causes, and greatly improves service continuity. Up to 90% of transient faults can be cleared with Kyle reclosers with no significant damage to conductors.

Substation Applications

The Kyle type R three-phase recloser is a completely automatic, self-contained power class unit. Because the type R is a heavy-duty recloser it has applications in substations with up to 100,000 kva fault capacity.

The type R provides simultaneous tripping on all three phases of the feeder, to assure maximum protection against back feed or three-phase motor burnouts. Three time-current characteristics are available for series over-current tripping, with four operations to lockout in any of seven sequences. Normal reclosing time is two seconds. (25-cycle reclosing is available by simple field adjustment.)

Auxiliary Protective Schemes

Almost any relay scheme is adaptable to the type R recloser to supplement normal series over-current tripping.

Ground Trip Solenoid is a self-contained ground relay possessing its own dual time-current characteristics.

Shunt Trip Solenoid is a tripping device only, designed to operate the recloser when energized from a supplementary relay scheme.

Shunt Lockout Solenoid is a lockout device only; locks out the recloser instantly. Like the shunt trip solenoid it is energized by remote control.

Auxiliary Switch provides positions for remote-control indication or low-voltage control switching of apparatus used in conjunction with the type R recloser.

Ratings From 25 to 400 Amps.

The type R is available in normal load ratings from 25 to 400 amperes, with symmetrical RMS interrupting ratings up to 6000 amperes at 4.8 kv and below, and 4000 amperes up to 14.4 kv. Ratings can be increased in the field by simply changing the series trip coil.

Get the Whole Story on L-M's Kyle Reclosers and Sectionalizers

Ask your L-M Field Engineer for information and bulletins on Kyle apparatus and complete coordination—single- and three-phase—from substation to load. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

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LINE MATERIAL Kyle® Reclosers

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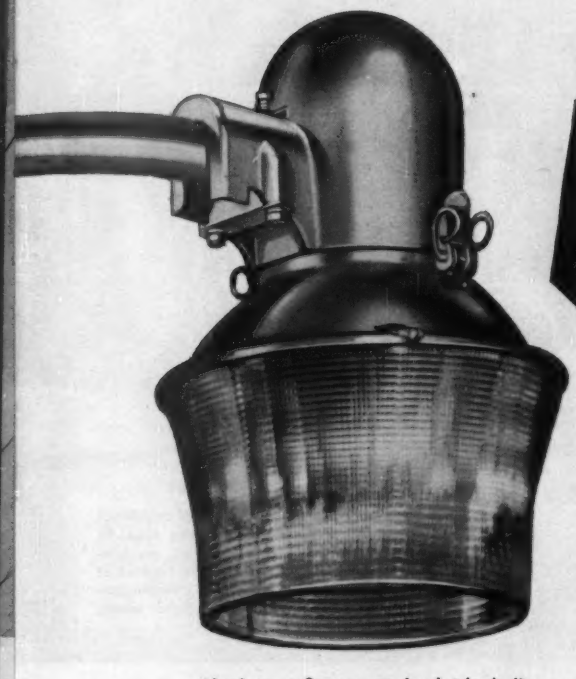
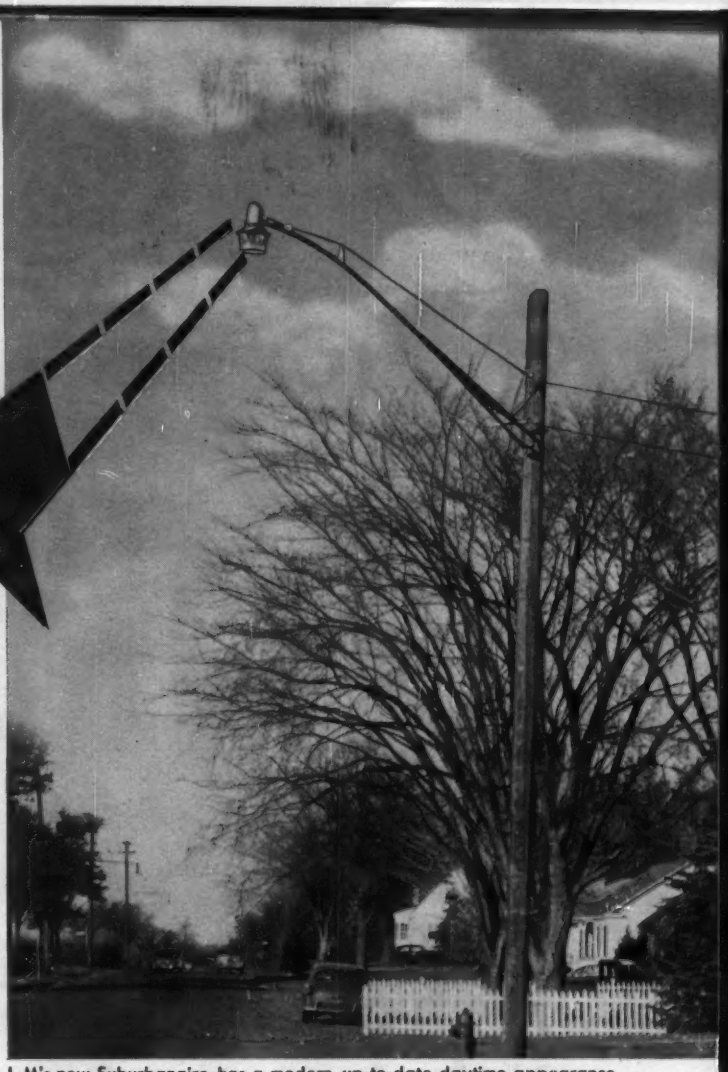


Aluminum reflector can be latched directly to a standard NEMA head. Since the Suburbanaire is open at the bottom, the refractor does not need to be removed for relamping.



L-M's new Suburbanaire has a modern, up-to-date daytime appearance.

How L-M's Suburbanaire Improves Residential Lighting, Cuts Maintenance

L-M's new open-refractor Suburbanaire is an outstanding improvement in residential area luminaires. The open glassware provides for excellent cooling, larger lamps, and easy re-lamping. In addition, the Suburbanaire has a pleasing daytime appearance.

The Holophane® refractor glassware is available in type I, standard type II, type II 4-way offset, type III and type V light patterns. The unit offers greatly improved lighting over open luminaires often used for neighborhood streets.

Check These Outstanding Features

L-M's Suburbanaire Is More Efficient—

- Specially designed for long life, low wattage, and clear and color improved mercury vapor lamps including the new 100 watt (3300 lumens) and 175 watt (6800 lumens). Accommodates incandescent lamps up through 6000 lumens. Integrally mounted head and ballast assembly available for use with HG lamps.
- Provides more light at higher angles, making it adaptable to wider spacings which are typical in residential areas.
- Glare is at a minimum, even with high beam candlepower at a high angle, because of the large glass area, which provides a beacon effect with large light source. The light is developed from the entire refractor, not just from the area next to the reflector.
- Has high utilization of light output and improved efficiency.

L-M's Suburbanaire Cuts Maintenance Costs—

- Eliminates the problem of trapped dirt and condensation which collect in enclosed units.
- Relamping can be done without removing glassware. In many cases it can be done from the ground with a lamp stick.
- Alzak® aluminum reflector is latched for easy attachment to standard NEMA head. V-band permits field replacement of glassware when necessary.

Ask the L-M Field Engineer or Street Lighting Engineer for more information on features of L-M's Suburbanaire luminaire. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

LINE MATERIAL

A McGRAW ELECTRIC COMPANY DIVISION

Street Lighting

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When ordering lighting equipment, protect yourself. Insist on quality products that meet the exacting requirements of EEI-NEMA standards (Edison Electric Institute and National Electrical Manufacturers Assn.)

Guy rod, pipe and parts are all firmly packaged together. Storeroom space has been reduced considerably because it is no longer necessary to have a separate bin for each part.

Why L-M Luminaire Supports Are Easy To Handle, Easy To Store

L-M's complete line of steel or aluminum luminaire supports is shipped packaged, with guy rod, pipe and parts firmly strapped together. All threaded parts of each support are protected with a plastic coating. The pole fitting and brace support are welded to the bracket, which reduces the number of parts.

How Packaging Saves Time and Storeroom Space

Because all parts for L-M's luminaire support are packaged together, they can be stored as a unit, eliminating separate bins for each part. Parts are not lost in shipment or in the storeroom when packaged together. The correct components will always be sent to the job site.

L-M's luminaire supports are designed for—

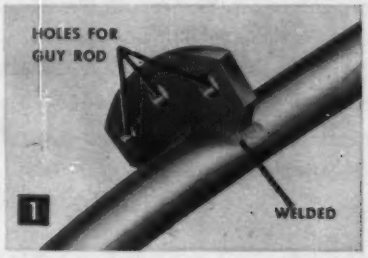
Appearance: L-M provides four harmonizing styles of supports so that several types can be used in the same installation, if desired. The supports are "upsweep" in design to give a handsome appearance.

Strength: Completely wind-tunnel-tested, L-M's luminaire supports are designed to withstand winds up to 150 M.P.H., to assure generous lateral strength. The supports can also withstand heavy non-sustaining vertical loads up to 250 pounds without collapse or rupture. The pole fitting and brace support are welded to the bracket to insure ample strength and minimize vibration.

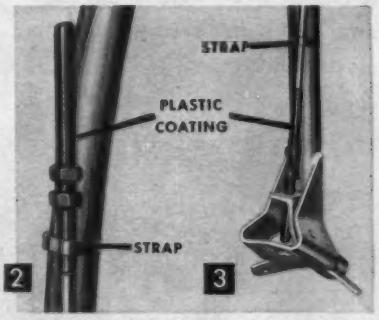
Meet Proposed EEI-NEMA Standards: L-M supports meet the new proposed EEI-NEMA standards for strength and minimum pole mounting requirements. The minimum pole space advantage makes these supports particularly desirable for joint-use poles.

Complete Line of Luminaires and Supports

L-M supports are available in lengths up to 20 feet, in steel or aluminum. L-M also offers a full line of street lighting luminaires—incandescent, mercury vapor, and fluorescent—and complete street lighting application engineering service. Ask the L-M Field Engineer for information and bulletins. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.



Support for guy rods is welded to the bracket. This reduces the number of parts, adds strength to the bracket, and minimizes vibration.



Nuts and threaded parts are covered with a plastic protective coating. Brace is firmly strapped to the bracket to facilitate shipping, handling, and storage.

4 Each L-M luminaire support is identified with an easy-to-read label which lists the catalog number and illustrates the mounting, length, and rise dimensions.

When ordering lighting equipment, protect yourself. Insist on quality products that meet the exacting requirements of EEI-NEMA standards (Edison Electric Institute and National Electrical Manufacturers Association).

LINE MATERIAL
McGRAW ELECTRIC COMPANY DIVISION
Street Lighting

we're on our way at with new and better service for YOU!

the roof is off!

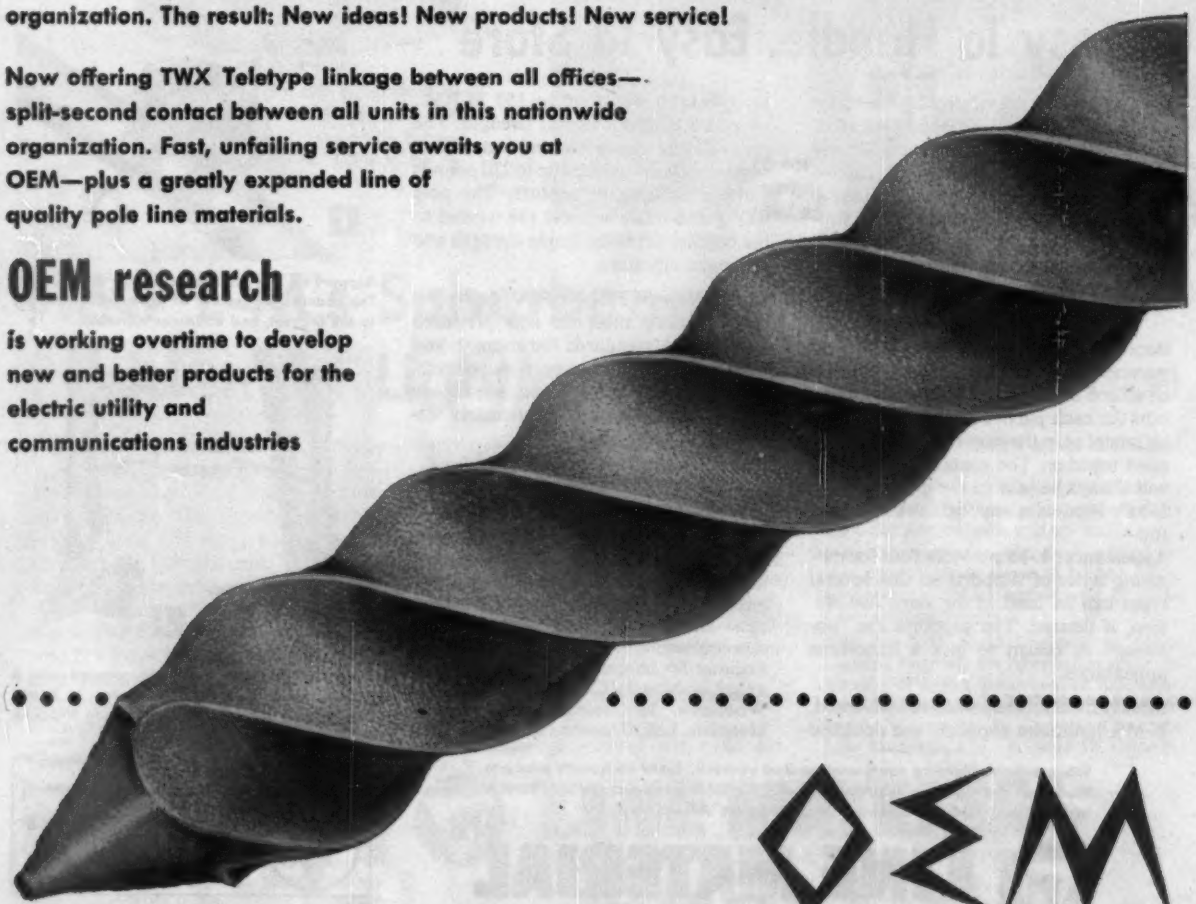
Oliver, oldest name in pole line material, has joined forces with young, energetic Electrical Manufacturing Company to become the new OLIVER ELECTRICAL MANUFACTURING COMPANY!

Oliver's tremendous manufacturing, and widespread warehouse facilities have been combined with Electrical Manufacturing's alert research and development organization. The result: New ideas! New products! New service!

Now offering TWX Teletype linkage between all offices—split-second contact between all units in this nationwide organization. Fast, unfailing service awaits you at OEM—plus a greatly expanded line of quality pole line materials.

OEM research

is working overtime to develop new and better products for the electric utility and communications industries



OEM

O.E.M.
and products

a new lag screw is ready!

The newly developed Twist-Drive, OEM Lag Screw—available at no extra cost—is designed for use wherever gimlet-point or fetter-drive lag screws might be used. NO WRENCHING required—just drive it in. Twists its way, cutting its own threads. Has great holding power. Won't rupture wood fibres, insuring against costly wood rot later.

A small, round projection on the lag screw head absorbs hammer blows, keeps head from being damaged or distorted, and permits use of wrench for easy removal. Two sizes with square or washer heads—½" x 4" and ½" x 4½"—in stock for immediate delivery at all warehouses. Other sizes available in production quantities. Write for free samples, (square head: #5734—½" x 4", #5734½—½" x 4½". Washer head: #5724—½" x 4", #5724½—½" x 4½").

Gimlet-point lag screw has conventional wood-screw thread and point; is designed to be entirely "wrenched" into wood with twisting motion.

Fetter drive may be driven ⅗ to ¾ of the way into the wood, operation being completed by wrenching several turns.

New Washer Head
Twist Drive lag screws are an exclusive OEM product. Integral washer provides broad bearing surface and eliminates static. Also available at no extra cost.

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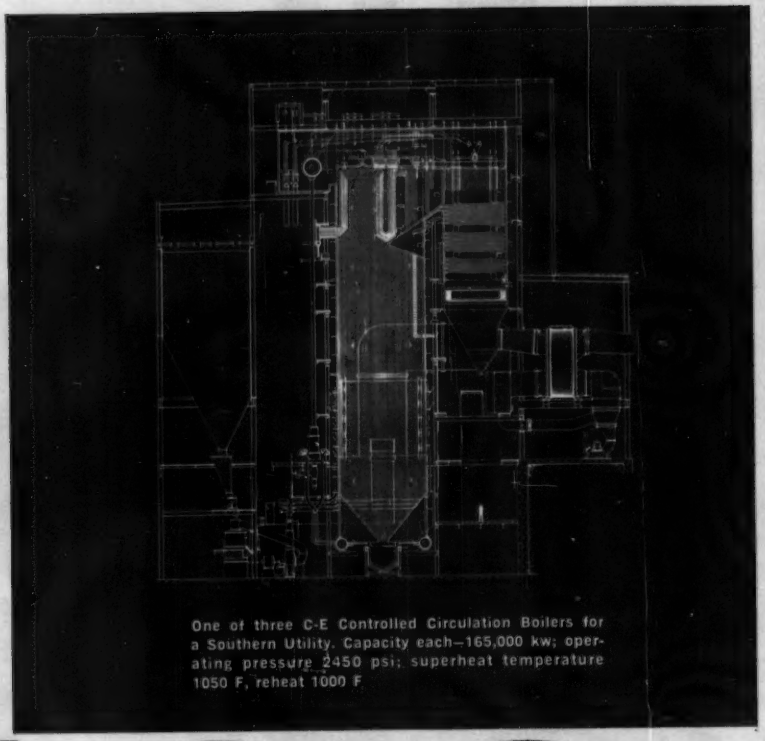
OLIVER ELECTRICAL MANUFACTURING COMPANY

Box 217—Battle Creek, Michigan

Factories in Pittsburgh and Battle Creek; warehouses in Battle Creek, Boston, Birmingham, Chicago, Dallas, Pittsburgh and St. Paul.



One of three C-E Controlled Circulation Boilers for a Southern Utility. Capacity each—165,000 kw; operating pressure 2450 psi; superheat temperature 1050 F, reheat 1000 F

2400

The Outstanding

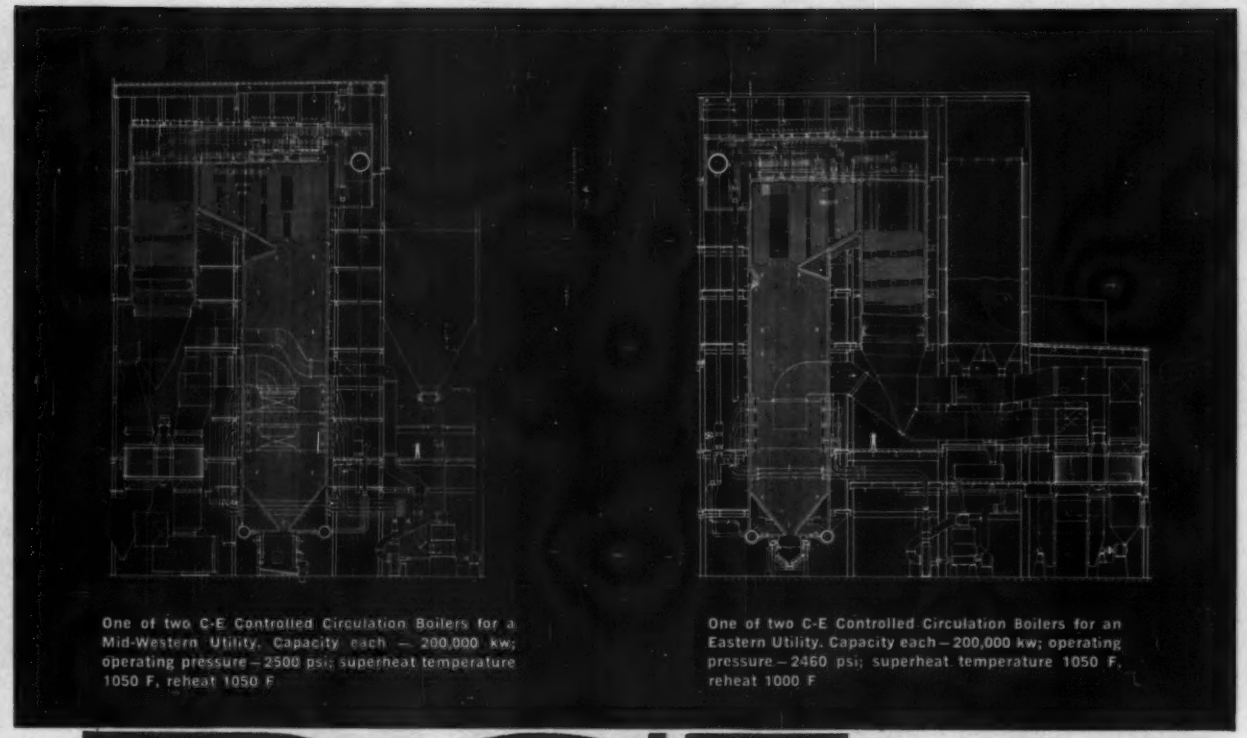
In 1956, the most notable trend in power plant practice was the large-scale adoption of the 2400 lb pressure cycle. In this pressure range, the utility industry purchased more than twice as many C-E units as they did in 1955. These units range in size between 125 mw and 325 mw. Operating pressures ***at the turbine throttle*** range from 2400 psi to 2620 psi. Of course, all are Controlled Circulation Boilers and 3 units are of the C-E Sulzer "once through" design. All units are equipped with C-E Tilting Tangential Burners and, in the larger sizes, a number are of the C-E Twin Furnace design.

COMBUSTION

Combustion Engineering Building

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

Dependable All-Wheel traction



One of two C-E Controlled Circulation Boilers for a Mid-Western Utility. Capacity each — 200,000 kw; operating pressure—2500 psi; superheat temperature 1050 F, reheat 1050 F

One of two C-E Controlled Circulation Boilers for an Eastern Utility. Capacity each—200,000 kw; operating pressure—2460 psi; superheat temperature 1050 F, reheat 1000 F

PSI

Power Trend of 1956

Orders placed for C-E Boilers in this pressure range, including three purchased prior to 1955, now total 32 units with an aggregate capacity of over 5,500,000 kilowatts. This remarkable record is attributable to the proven suitability of the C-E Controlled Circulation Boiler for the highest range of sub-critical pressure and to its outstanding performance, especially with respect to availability.

The capacity of all C-E Controlled Circulation Boilers ordered since 1950—covering a range of turbine throttle pressures from 1500 to 2620 psi—now totals well over 16-million kw of which approximately 5½-million kw is in service. The cumulative service of these installations is equivalent to more than 60 boiler years.

As this record demonstrates, Combustion designs have anticipated advancement in power practice and have made a significant contribution to the all-important industry objective of achieving ever lower generating costs.

ENGINEERING

200 Madison Avenue, New York 16, N. Y.

C-E

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

Dependable All-Wheel traction

One of 9 reasons why you'll find International Trucks cost least to own!

Here are 4-wheel-drive and 6x6 trucks that need no roads. They make their own with all wheels *working*.

You get dependable sure-footed traction and extra pulling power to go through sand, mud and snow . . . up the steepest grades with a full load. No need to take the long way around. Ideal for highway hauling, too.

Every INTERNATIONAL All-Wheel-Drive model is completely factory-built for reliable performance and lasting economy . . . built to cost *least* to own.

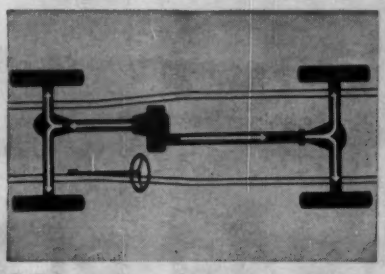
And fleet cost records prove* that INTERNATIONAL Trucks *do* cost least to own.

Why not start *saving* more, *earning* more money right now with the rough-and-ready truck that goes everywhere. Your INTERNATIONAL Dealer is the man to see.

**Signed statements in our files, from fleet owners throughout the U.S., back up this statement.*

INTERNATIONAL HARVESTER COMPANY, CHICAGO
Motor Trucks • Crawler Tractors
Construction Equipment • McCormick® Farm Equipment and Farmall® Tractors

1 All wheels are working for you with this INTERNATIONAL 6x6. You get to places never before possible. Rough terrain and hills are easily negotiated. Save valuable time and money. 6x6 models with 22,000 to 43,000 lbs. GVW.



2 Two-speed transfer case transmits power from the transmission to front and rear axles or rear axle only. Quiet, cloverleaf design for straight-thru drive, extra dependability and lowest maintenance. Full torque power take-off available.

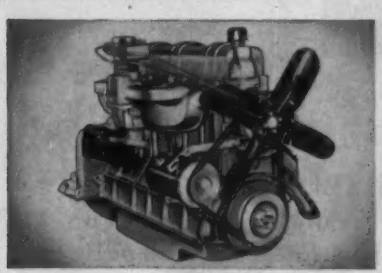
3 Brakes with big lining areas are the self-energizing type for low pedal pressure and sure stops. Sealed to keep out dirt and moisture for greater dependability and reduced service. Power brakes standard or available on all models.

4 Every cab is a full-sized beauty. Plenty of leg and head room, 3-man-wide seats. Sturdily constructed with double back walls. Special cab mountings, rugged understructure and bracing to stand up under the most extreme conditions.

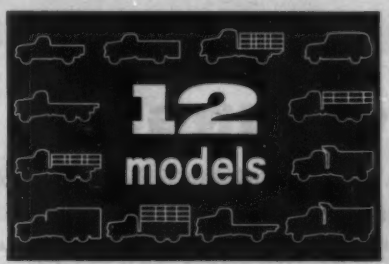
5 INTERNATIONAL Steel-Flex frames are constructed with cold squeezed rivets for added strength and durability. S-120 (4x4) models have kickup for extra low loading height. Larger models have full load-length reinforcements.

6 Easy, positive steering with over-size cam and roller-mounted twin lever gears. Controls mounted ahead of the front axle. You get greater stability, less shocks, comfortable steering angle . . . best handling on all types of terrain and roads.

This is the popular light-duty Model S-120 (4x4) INTERNATIONAL Truck. Features full-size, 3-man-wide cab and a choice of 12 different full-size, factory-built bodies, including the widest 6½ ft. pickup in the industry. Powered by 131 hp., short stroke, 6-cylinder engine, gasoline or LPG fuel. Available with factory-installed 8,000 or 15,000 lbs. capacity front-mounted winch, snowplow and other specialized equipment.



7 **Dependable, economical power** with sixteen 6-cylinder engines, up to 212 hp. Heat-treated, forged steel crankshafts and big bearing areas for a longer, more useful life. Precision machined, quiet, long lasting timing gears, too.



8 **Save time and money.** Get the truck that matches your job *exactly*. No need to compromise with the great span of 12 factory-built INTERNATIONAL 4x4 and 6x6 models, 7,000 to 43,000 lbs. GVW. Choice of job-matched components.

9 **World's most complete line.** There is an INTERNATIONAL "tailor-made" for every truck job, ½ tonners to 90,000 pounders. Choice of 4-wheel, 6-wheel and all-wheel-drive models, conventional and COE design. Every one built to cost *least* to own.

FORGED CRITICAL PARTS *keep today's cars moving . . .*

FORGED STRAIN CLAMPS *keep power moving too!*

63 DROP FORGINGS . . .

go into the average automobile—with all but 4 of these in the critical steering assembly, engine, and power train. The use of forgings eliminates premature failure of key members where fatigue and impact stresses are concentrated and heavy wear occurs. In today's cars the achievement of more power and greater speed demands forged steel components possessing high strength while reducing overall weight.

IT PAYS TO SPECIFY FORGINGS for your transmission lines. Take strain and angle construction, for instance. Because BTC Strain Clamps are drop-forged, they offer a completely dependable, efficient means of dead-ending conductors.

The general design of these Clamps combines the strength, toughness and lightweight of forgings with a considerable reduction of the factors causing conductor-vibration-fatigue damage. Slip strengths are more than adequate. Designed for all conductors in general use, BTC Strain Clamps are suitable for all classes of dead end construction, all line current loads and voltages and all conditions of atmospheric corrosion. They are easy and economical to install —no special tools required. The conductor may be strung between Clamps, or from Clamp to Apparatus, without cutting or splicing, insuring permanently trouble-free operation.

Choose the right Clamp for your conductor from the BTC line. You'll find BTC Conductor Strain Clamps available in a wide range of sizes.

5000 SERIES

Steel Strain Clamps. Drop-forged steel, hot-dip galvanized, suitable for all conductors. May also be ordered with Aluminum or Copper Liners.

5200 SERIES

M.P.L. (Minimum Power Loss) Aluminum Strain Clamps. Drop-forged, heat-treated Aluminum Alloy Clamps for A.C.S.R. and All-Aluminum Conductors.

Specify BTC **DROP-FORGED Hi-Line Hardware**

. . . from your Insulator Manufacturer

The BREWER-TITCHENER CORPORATION, Cortland, N. Y.

New space-miser network transformer now 12″ shorter, 20% lighter, occupies 15% less space

Slashing maintenance a dozen ways is the story of the new Westinghouse 500-kva subway transformer. Easier servicing and even better electrical performance place this product in a class by itself.

1. Protection against partial vault flooding—with a 12″ reduction in height, transformers can now be off the floor, set on I beams.

2. Installation easier, handling safer—new transformer is 20% lighter.

3. Contoured . . . round corners replace sharp edges on new diving bell tank.

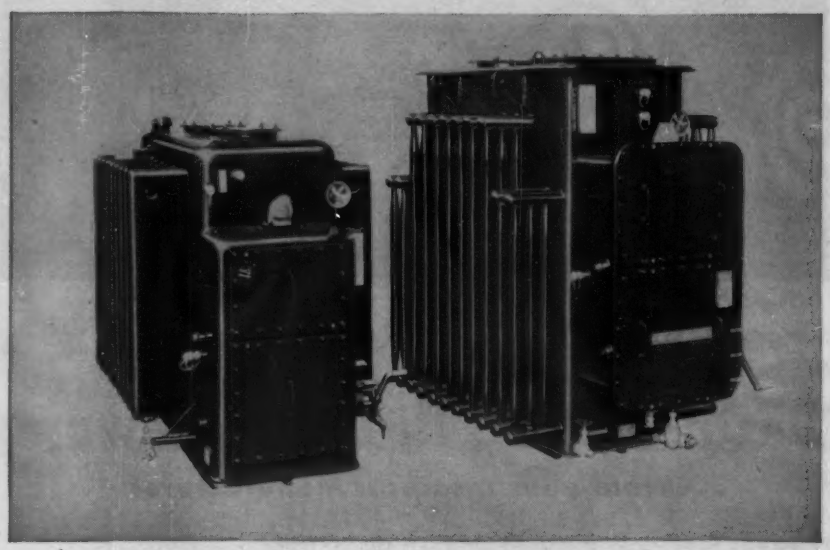
4. Easier to wash down and paint, virtually self-cleaning—new contour design of Yukon Coolers eliminates 68 former sources of corrosion.

5. More accessible high-voltage terminal chamber—exclusive integral tank design lowers switch compartment; switch and core-coil assembly now housed in one smooth, unwelded exterior on a common base plate.

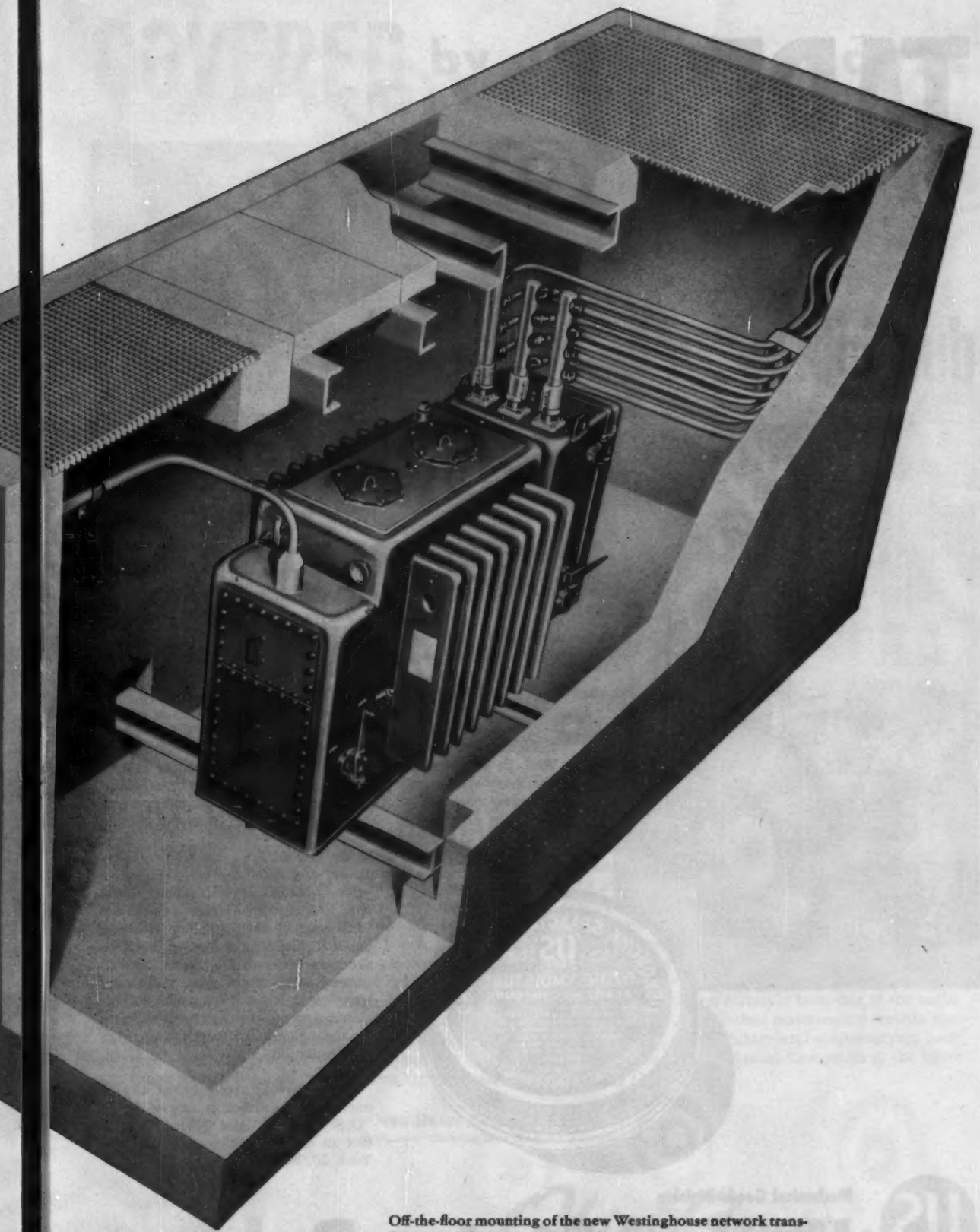
For network transformers that set the standard, talk to your Westinghouse sales engineer, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70781

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***



(*Right*) Previous 500-kva network subway transformer. (*Left*) New Westinghouse design features exclusive Yukon Coolers, greater spacing, more clearance to floor—refinishing is no problem.



Off-the-floor mounting of the new Westinghouse network transformer minimizes contact with corrosive matter; inspection and maintainance are quicker, easier.

TAPE IT for durability with

USKORONA

the only tape that resists both moisture and ozone

Uskorona tape will *not* break down. Just how rugged is this tape? Well, in a corona-(ozone) resistance test of 4 leading brands, Uskorona was the only tape still intact after 4 hours of exposure. All others broke down. Even after 1500 additional and *consecutive* hours of exposure, Uskorona remained as fresh and corona-resistant as at the start.

Electrical engineers insist on Uskorona in the design, installation, operation and maintenance of power lines wherever corona or moisture is a problem. Uskorona provides ideal insulation in splicing electrical cables on underground power lines, on secondary network systems, underground street lighting circuits, and transformer leads. It fuses with and becomes a part of the insulation and gives the *same* dielectric strength as the original insulation. Exceeds A. S. T. M. specifications.

Uskorona® is obtainable at any of our selected distributors, any of the 27 "U. S." District Sales Offices, or contact us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

United States Rubber

COVERED by a decade of dirt...

...and 3 decades of research

Part of the contamination exposure area adjoining the O-B High Voltage Laboratory. Another space, equally large, is devoted to regular and experimental pintype, post, and station insulators. Each test specimen is energized. Each is connected to its own set of laboratory instruments that evaluate and record amplitude and frequency of leakage surges. Slowly but surely, these insulators are writing an authentic history of contamination leakage phenomena. And with equal sureness, they are helping to guide today's and tomorrow's O-B insulator designs.

Do you want to study industrial contamination of insulators? Come to the O-B High Voltage Laboratory—we've got plenty of it! This, in fact, is one of our prize "facilities."

Going back some 20 years, we began taking advantage of our fouled-up industrial surroundings. Test samples were put on exposure racks and watched for their behavior. In the ensuing 10 years, our basic understanding of leakage current phenomena improved greatly and led to a much more refined test set-up, including individual automatic measuring equipment on every specimen. This permits detailed investigation of the nature and action of leakage currents—the end-product of contamination. This thorough piece of research, in its present highly organized condition, is now 10 years old. By a fully controlled laboratory study of *natural* conditions, we get *the facts!*

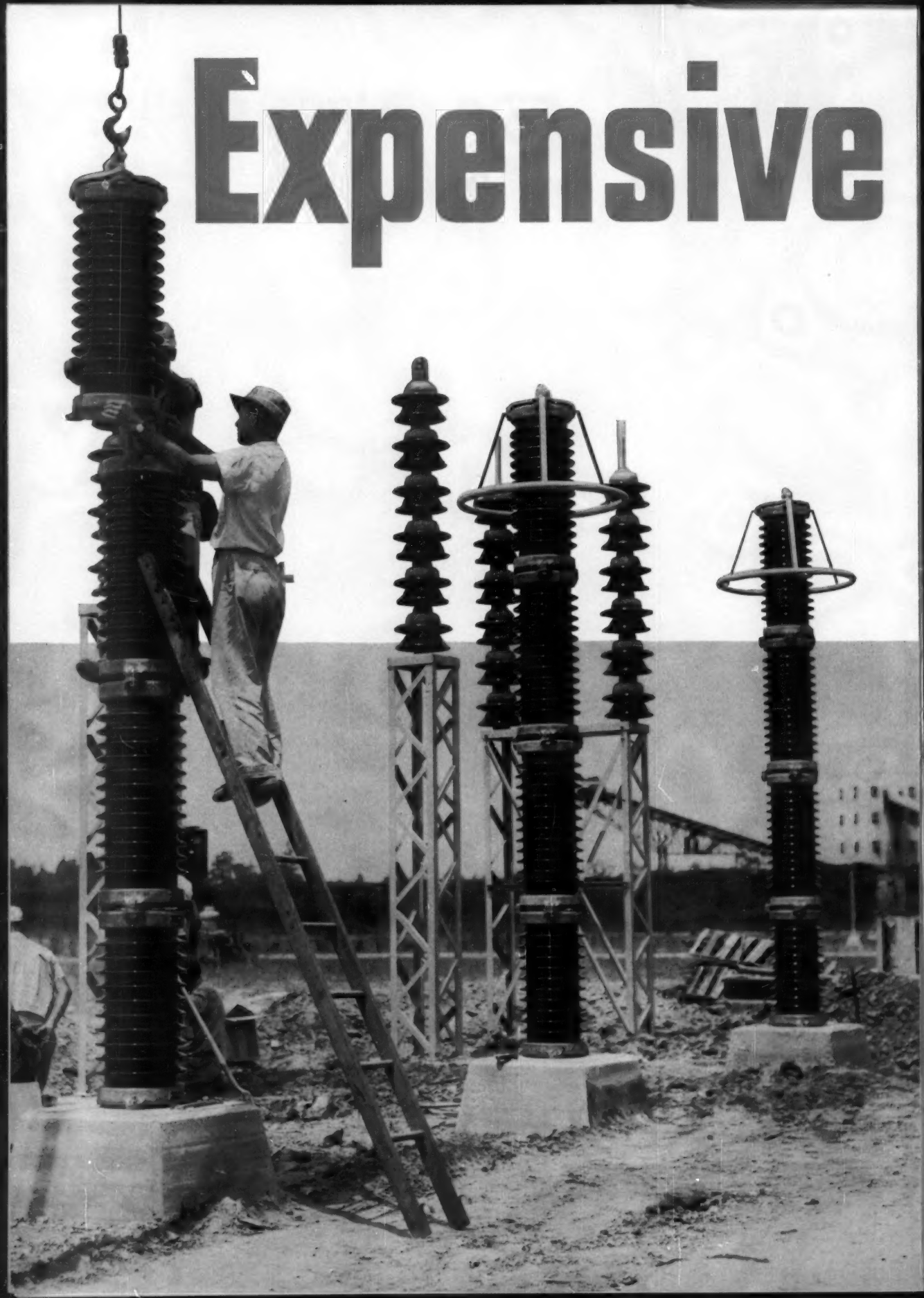
This long-time technical project moves us back into an earlier period of electrical manufacture, when competent laboratories were even more scarce than today. Going back 20 years to the beginning of this investigation, however, the O-B laboratory was then nearly 10 years old.

This background of some 30 years of capable, organized research has certainly been one of the larger factors in O-B's unmatched performance records, and in the steady, solid product improvements that have been imparted by Technical Competence, the heart of every O-B insulator.

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

TECHNICAL COMPETENCE the heart of every Ohio Brass insulator

Expensive



extras disappear

When You Protect Stations with Thorex Lightning Arresters

Typical of the money you can save with Thorex lightning arresters are these two recent cases.

A Southern property built a complete three-pole, 230-kv arrester with two ground men and a hoist operator in a total elapsed time of 1 hour and 28 minutes.

An Eastern property built a similar 230-kv Thorex arrester in only seven minutes per pole, again using only three men. Moving equipment between poles took additional time, but the job was cleaned-up in less than an hour.

Absolutely no external auxiliary supports were required for these 230-kv arresters. All the high costs of bracing were eliminated.

One arrester, complete, took 4¼ man-hours. The other took 3 man-hours. *And that was all!*

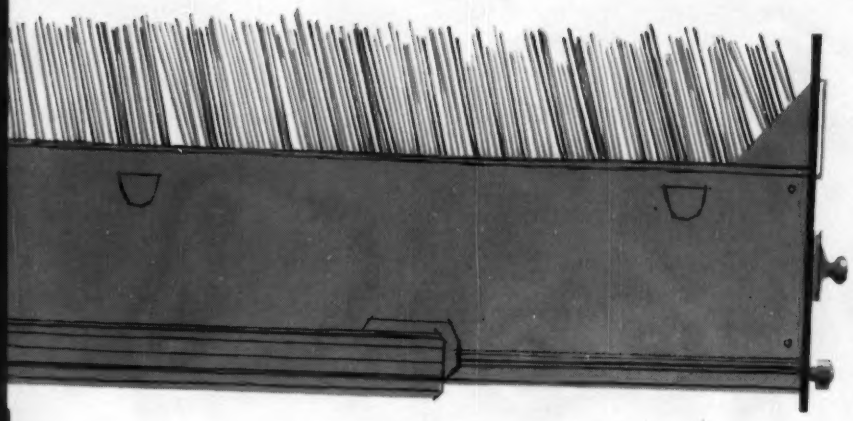
When do you consider an arrester is paid for? After you've paid the manufacturer's invoice? Far from it -- sometimes. You may not have gone more than half way. But when that arrester is a Thorex, expensive extras disappear.

Granted, no arrester is a bargain if it lacks protection. But the Thorex meets all published standards, comfortably. On top of this it has added protective features found nowhere else. It's really worth a premium, while it actually costs you less.

Is Thorex in your future planning? If not, a few minutes spent investigating it will be mighty profitable.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass



The best reason for using O-B Station Insulators is probably RIGHT IN YOUR OWN FILE

It's almost impossible to tell one make of station insulator from another. National Standards specify most physical characteristics. Does this mean they're all the same?

Remember, these Standards do not *and cannot* touch on ultimate life. No "as new" test will determine the end point of insulator service. However, since cost is competitive, yet big differences exist in life, it is obvious that one will give you much more for your money than another.

Mere claims don't mean very much -- anybody can make them. But it would be surprising if there were not hundreds or perhaps thousands of O-B station insulators now on your system. Have you ever investigated their record; made comparisons? We are making no statement we can't prove, especially when the *real proof,* on your own terms, is now probably on file at your office.

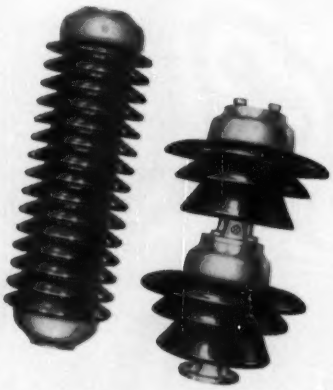
If you look it up you are likely to find that you -- not us -- can furnish the best reason for specifying O-B station insulators on your system.

4773-H

Ohio Brass

MANSFIELD OHIO, U.S.A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.



all mobile radio users need this dependable receiver

for silent monitoring of Civil Defense alerts!

CONELRAD
TYPE CR-17A
RECEIVER
Rules and regulations of the FCC require every station in the Amateur, Standard Broadcasting, Public Safety, Special Industrial and Land Transportation Radio Services to observe all Conelrad radio alerts.

In buying equipment for Civil Defense monitoring purposes, you will want to have the most foolproof equipment. RCA's Type CR-17A Conelrad Receiver offers the following noteworthy features:

1. *Silent*, annoyance-free monitoring plus provision for audible monitoring and external alarm.

2. Automatic switching to preset Conelrad frequency in event of an alert.

3. In absence of radio signal, automatic switching between broadcast station and Conelrad "cluster" stations until signal from one or other is received.

4. Designed for continuous operation.

5. Two tuning sections—Section 1 is tunable to any frequency in broadcast band; Section 2 is preset to Conelrad frequency 640 or 1240 kc.

6. Supersensitive, permanent-magnet electro-dynamic speaker assuring fine performance and volume.

7. Fulfills requirements of Federal Communications Commission.

******Price in U.S.A., subject to change without notice.*

Use coupon for ordering or information

RCA

RADIO CORPORATION of AMERICA

COMMUNICATIONS PRODUCTS

CAMDEN, NEW JERSEY

In Canada: RCA VICTOR Company Limited, Montreal

Radio Corporation of America
Communications Products, Dept. NE-45
Building 15-1, Camden, N. J.

☐ Please send me_____RCA Type CR-17A 550-1600 MC Conelrad Receivers @ *$115 ea.

☐ Check enclosed ☐ Bill Company

We absorb shipping charges within Continental U.S.A. on all prepaid Conelrad Receiver orders.

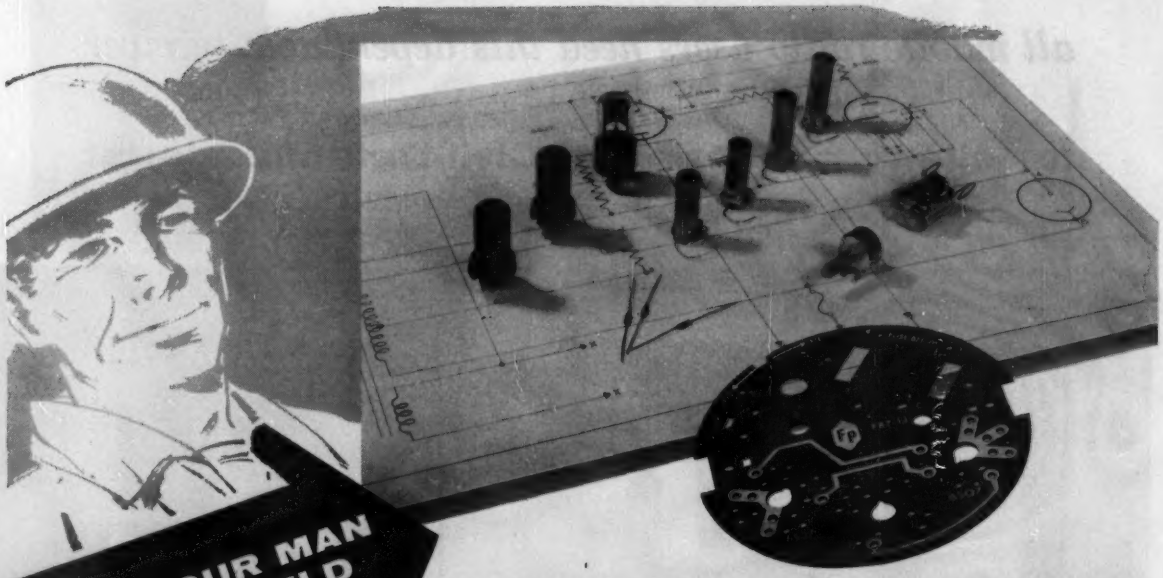
☐ Send me complete information.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____



component quality

OF FISHER-PIERCE
PHOTOELECTRIC LIGHTING CONTROLS

A look inside any Fisher-Pierce photoelectric lighting control immediately reveals a primary reason why they require extremely low maintenance and provide long-run economy: *component quality*. Here are specific examples: two *pre-aged* amplifier tubes, instead of one dual triode, for a guaranteed minimum life of 20,000 hours; *wire wound* potentiometer; *Sigma* sensitive relay for low plate current drain of power tube; *linen-based bakelite* sub-mounting chassis and etched circuitry; *metal encased* paper capacitors (no electrolytics); blue-sensitive 1P39 phototube with non-hygroscopic base. No other photoelectric control provides such consistently high component quality. Combined with this are these four other important features.

DESIGN ADVANTAGES — Can be installed, serviced or removed safely and easily • Wide mounting versatility and orientation *after* bracket installation.

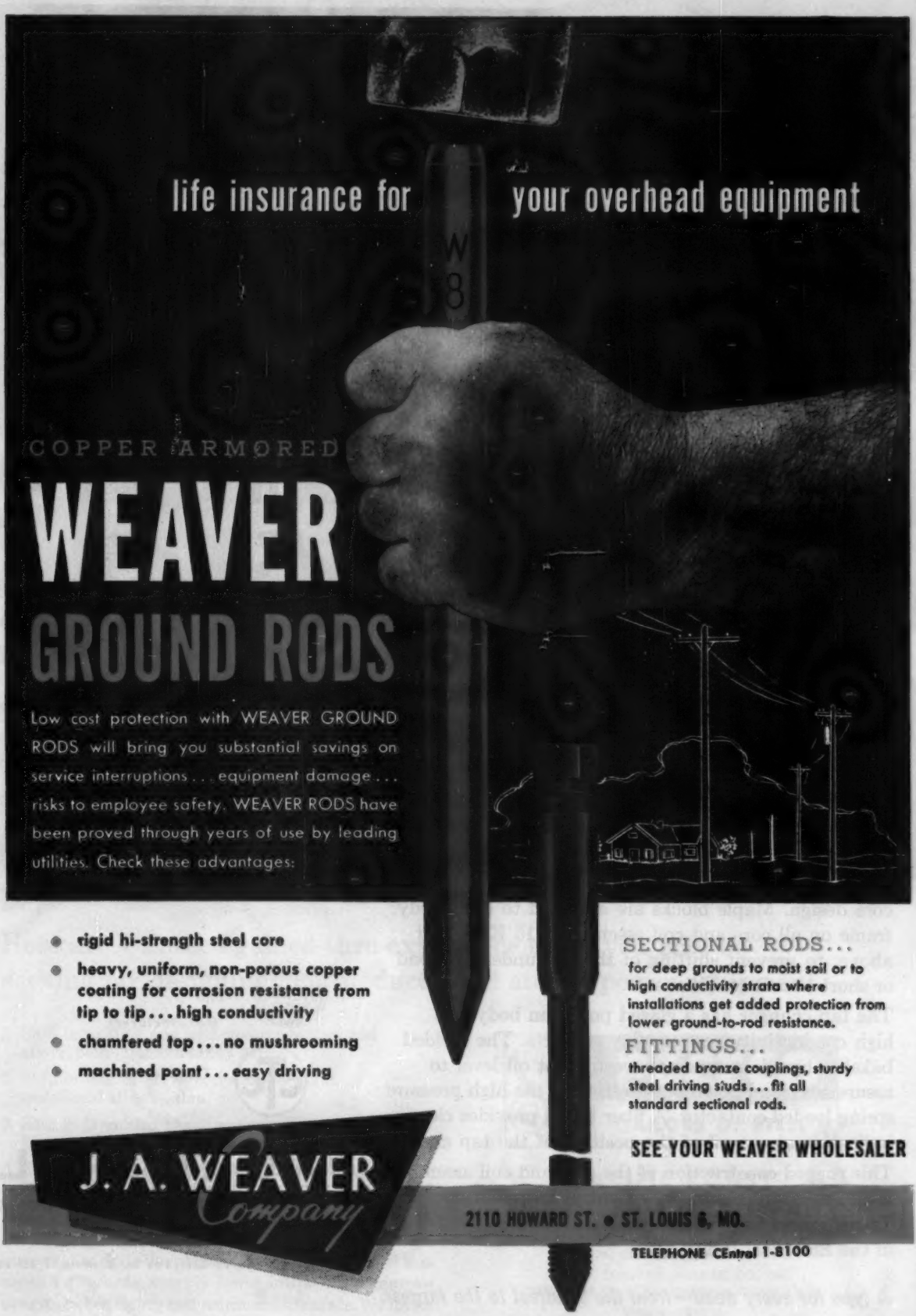
PROTECTION — From surges and lightning, by linen-based bakelite sub-mounting chassis and proper component spacing Circuit and load fuses, and lightning arrestor • Fail-safe operation.

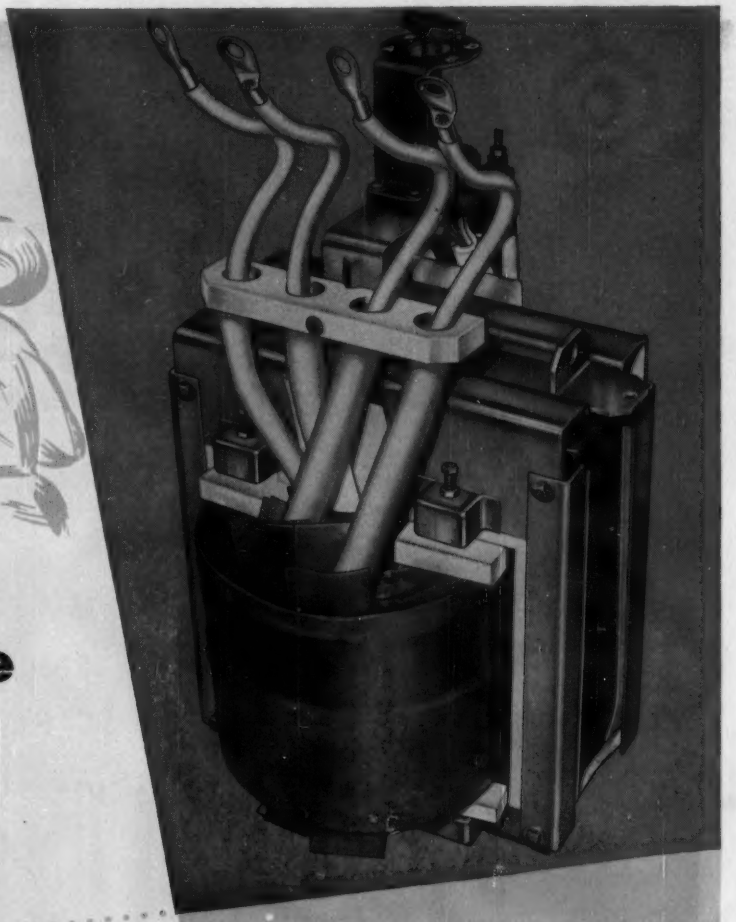
ADAPTABILITY — Three basic series and numerous models for all mounting requirements, operating voltages, load capacities and desired contact arrangements.

DEPENDABILITY — Proven by the thousands of F-P controls used by hundreds of utilities, over the past ten years.

Complete specifications and operating data are contained in informative F-P Bulletins, available on request. Or call the Fisher-Pierce sales representative in your area, for point-by-point proof of F-P superiority.

THE FISHER-PIERCE CO., INC.
82 Pearl Street, So. Braintree, Boston 85, Mass.


life insurance for your overhead equipment
COPPER ARMORED
WEAVER
GROUND RODS
Low cost protection with WEAVER GROUND RODS will bring you substantial savings on service interruptions . . . equipment damage . . . risks to employee safety. WEAVER RODS have been proved through years of use by leading utilities. Check these advantages:
rigid hi-strength steel core
heavy, uniform, non-porous copper coating for corrosion resistance from tip to tip . . . high conductivity
chamfered top . . . no mushrooming
machined point . . . easy driving
SECTIONAL RODS . . .
for deep grounds to moist soil or to high conductivity strata where installations get added protection from lower ground-to-rod resistance.
FITTINGS . . .
threaded bronze couplings, sturdy steel driving studs . . . fit all standard sectional rods.
SEE YOUR WEAVER WHOLESALER
J. A. WEAVER Company
2110 HOWARD ST. • ST. LOUIS 6, MO.
TELEPHONE CEntral 1-8100



Rugged Performance

built into core and coil assembly of Central Distribution Transformers

Only the best raw materials, design, workmanship and inspection go into core and coil assemblies of Central Distribution Transformers.

Grain oriented, cold rolled steel is used in the wound core design. Maple blocks are attached to the sturdy frame on all core and coil assemblies, 15 KVA and above, to prevent shifting of the coil under overload or short circuit conditions.

The tap changer has a glazed porcelain body and high conductivity copper alloy contacts. The molded bakelite handle extends above the hot oil level to assure easy and positive operation of the high pressure spring loaded contactor. A fiber board provides clear indication above oil of the position of the tap changer.

This rugged construction of the core and coil assembly is an important reason why Central Distribution Transformers have gained wide acceptance in the Electrical Industry.

A type for every need—from the smallest to the largest.

NEMA

Designers and Manufacturers of Transformers only

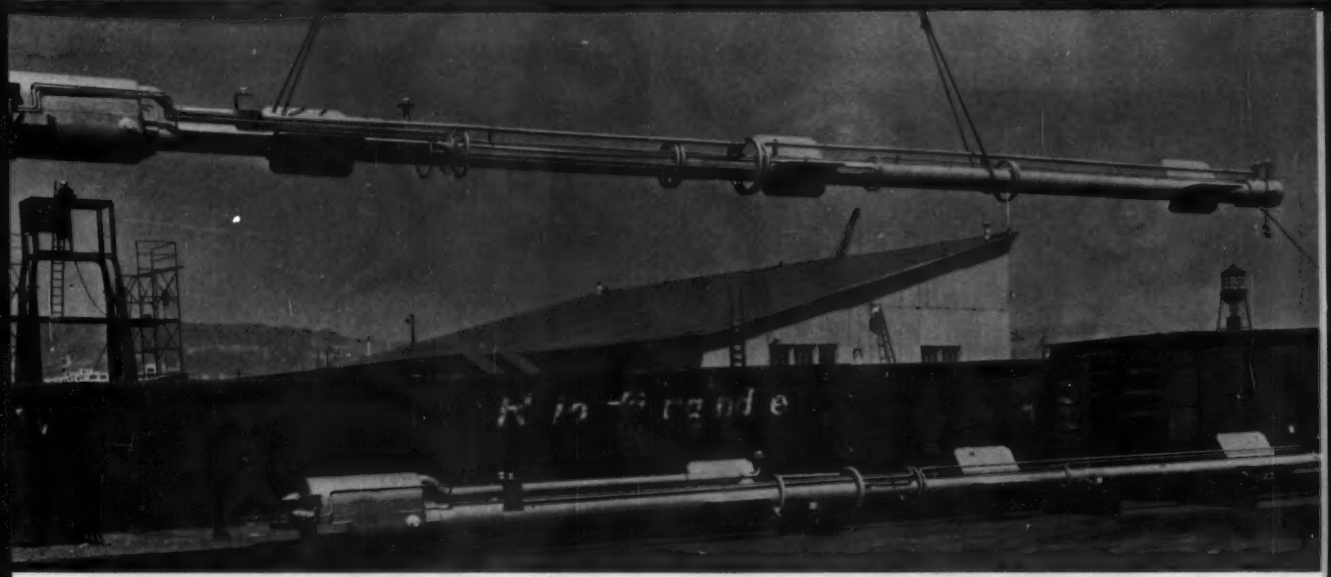
CTC

CENTRAL

TRANSFORMER CORP.

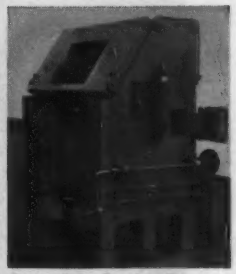
PINE BLUFF, ARKANSAS

Sales Offices in principal cities



*Stainless Towers for Hanford Works**

Cavity for Radiation Laboratory

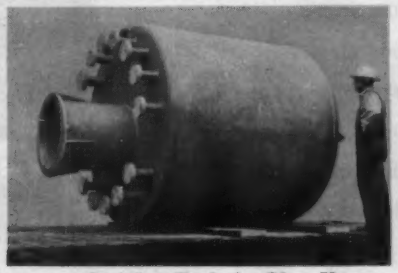


*One of 13 Junior Caves for Hanford Works**

DO YOU SEEK THIS EXPERIENCE WITH ATOMIC POWER PLANT EQUIPMENT?

*Structure Assembly for Hanford Works**

1 of 20 - 90' Span Cranes for Peter Kiewit



Stainless Tanks for Blaw-Knox

*Stainless Autoclaves for Hanford Works**

Here are 4 Paceco gained-thru-experience skills you may be seeking for designing and production of atomic power equipment

1. Skill in welding and heat treating of steel and alloys, both light and heavy gauge.
2. Skill in fabricating of corrosion-resistant metals and alloys.
3. Skill in producing heavy equipment to extremely precise mechanical tolerances.
4. Skill in designing and building equipment to resist extreme pressures and intense temperatures.

Some units we have built direct from buyer's plans. In other instances, however, Paceco engineers work with the buyer *at the designing stage*. Experience has proved this consultation may sharply lower initial cost, improve operational efficiency and reduce maintenance. We invite consultation on your requirements.

*Operated for the U. S. Government by General Electric Co.

PACECO
"TAILORS OF STEEL"®

PACIFIC COAST ENGINEERING COMPANY

ENGINEERS • MACHINISTS • FABRICATORS

ALAMEDA, CALIFORNIA, LAkehurst 2-6100

PACIFIC COAST ENGINEERING CO., INC.
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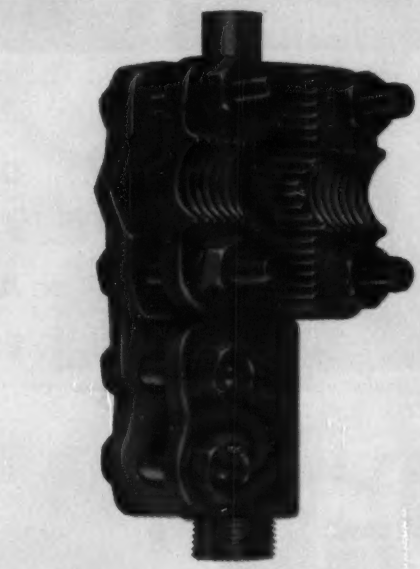
HOUSTON 2, TEXAS, 3619 Robinhood, MOhawk 3504

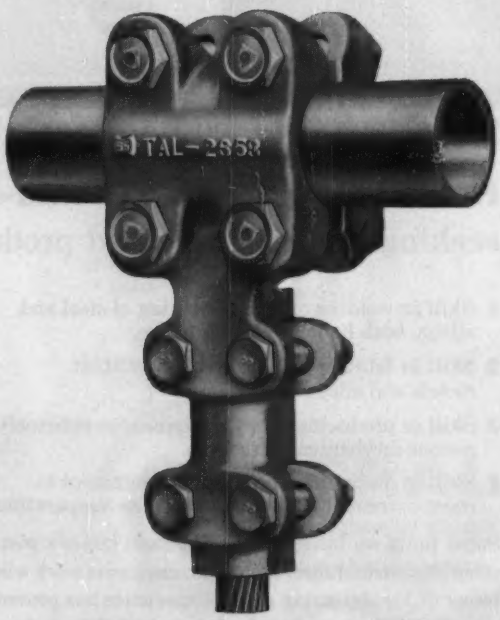
BRONZE OR ALUMINUM FITTINGS BY SOUTHERN STATES

Today, there is available from Southern States a wide choice of fittings in either bronze or aluminum. In addition to standard items, special designs can be quickly supplied to meet specific customer requirements.

Southern States aluminum connectors have exceptional cross-sectional strength, extra-large areas of contact engagement, and recessed self-retaining bolt heads. Like their bronze companions, they are fully capable of: 1) serving as self-supporting members; 2) providing a good electrical connection; 3) developing the full strength of clamping bolts without visible distortion; 4) carrying the current of the conductor without excessive temperature rise; and 5) being installed with a minimum of effort and time.

Specify Southern States fittings for the best protection at every connection.





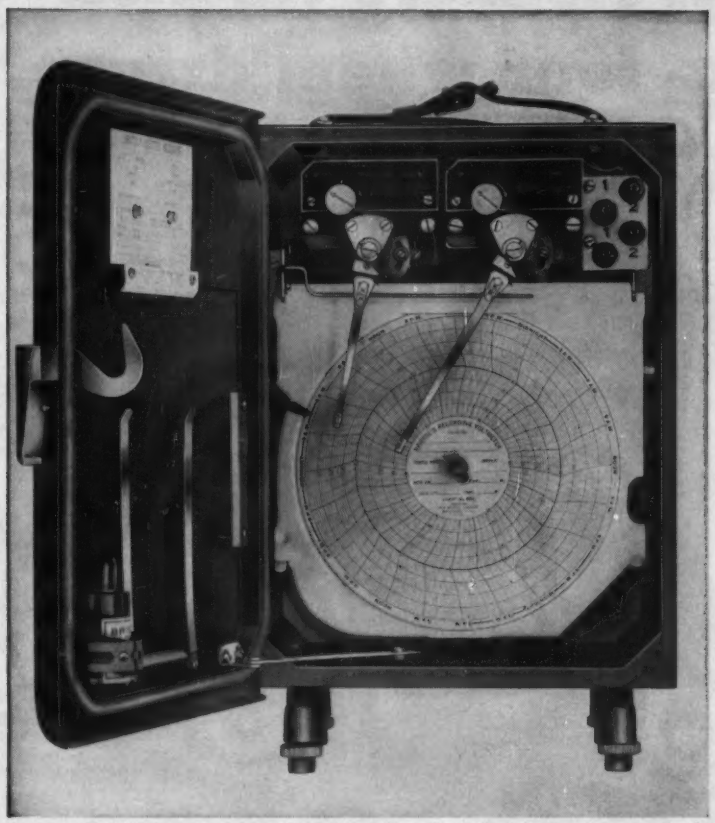
NEW! SOUTHERN STATES ALUMINUM CONNECTOR CATALOG NOW AVAILABLE

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

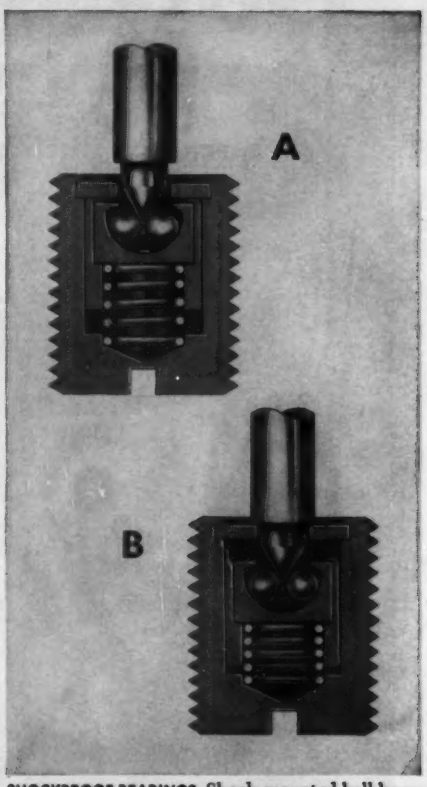
IN CANADA
Dominion Cutout Co., Ltd., Toronto

New! Two-pen Voltmeter

Two rugged reliable moving-iron elements provide independent records to ±1% on single chart: Similar two-pen ammeter available



BRISTOL'S® TWO-PEN VOLTMETER. Portable (*shown*) is ideal for on-the-spot checks requiring two simultaneous voltage records. Also available for portable and pole mounting use and for permanent installations.



SHOCKPROOF BEARINGS. Shock-mounted ball bearings support pivots at front and rear of the rugged moving-iron measuring element. In normal use (A) spring holds bearings against pivot. Under mechanical shock (B) spring absorbs impact.

Here's the ideal instrument for on-the-spot simultaneous records of two a-c voltages—either related or independent.

Bristol's new two-pen voltmeter has the same rugged moving-iron measuring elements as Bristol's standard electrical instruments. But there are *two* elements with *two* pens, providing *two* independent records on a two-zone chart!

The new voltmeter provides easy-to-read visual records and is valuable for such uses as checking the balance on single-phase three-wire systems and for visualizing voltage regulation. Available for portable, portable and pole mounting or for wall, switchboard, or flush-panel mounting. Two-pen ammeter model is ideal for portable use with split-core current transformers.

Here are some outstanding features of this new Bristol instrument:

High accuracy—±1% of full scale.

Two high-torque moving-iron mechanisms—Bristol's moving-iron mechanism produces greatest torque possible while keeping weight and power drain to a minimum. Assures positive recording over full range.

Low electrical burden—Only 5.5 volt-amperes at 120 volts or 12 volt-amperes at 240 volts for each voltmeter mechanism. Only 5 volt-amperes at 5 or 10 amps for ammeter.

High stability of calibration—Bristol's moving-iron mechanism is inherently stable, seldom requires calibration.

Easy calibration in field—Recalibration, if necessary, is easily accomplished by user without special tools or skills.

Rugged construction includes shockproof bearings, locking device to prevent pen movement in shipping or while carrying portable models.

Leveling not critical.

Write for complete data on this outstanding recording voltmeter today. The Bristol Company, 116 Bristol Road, Waterbury 20, Connecticut. 4.27

BRISTOL

TRAIL-BLAZERS IN PROCESS AUTOMATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

FWD delivers more traction with true four wheel drive...

because both power and weight are proportioned!

FWD sets poles where ordinary trucks can't go.

No need to skip the tough ones with new FWD.

Heavy-Duty Vehicle Specialists

THE FOUR WHEEL DRIVE AUTO COMPANY

There's a reason why utility men call FWDs "the trucks that get going where others have to quit." It's because they have the power and traction of *true* four wheel drive!

This is full time four wheel drive, not just a conversion kit. And the difference is important! FWD not only powers both axles all the time but properly divides driving torque according to the work to be done by each axle. This is the only truck that uses every pound of weight to produce traction.

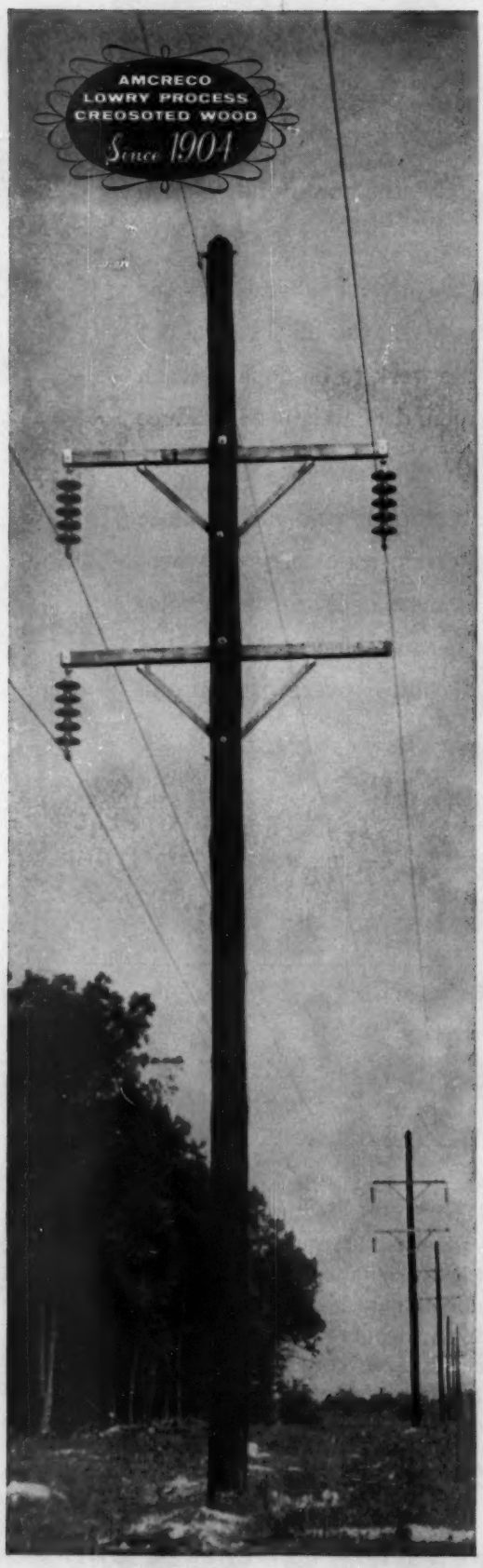
You see FWD outperform on day-to-day construction and maintenance jobs. And in rugged weather or off-highway terrain they carry on where other trucks have to quit. New FWD units dig more holes, set more poles than converted or conventional drive trucks because they're not limited to paths of least resistance. Your only real control over weather and terrain is powerful new FWD!

FWD saves time, goes direct to the job anywhere.

Name your job...
do it better with FWD!

FWD makes a full line of heavy-duty utility trucks including the "Rhino" front-mounted derrick and digger truck, regular and Cab-Over-Engine models with both four and six-wheel drives. These can all be fitted with bodies, PTO and equipment to match your requirements. Every model is engineered by the FWD utility division to fit the special requirements of utility duty.

CLINTONVILLE, WISCONSIN • *Canadian Factory* • KITCHENER, ONTARIO



Why Creosote is Still the Miracle Wood Preservative

Creosote contains not just one but over one hundred ingredients that are toxic to insects, fungi and all other natural enemies of wood. That's one reason why it has been and still is the most effective wood preservative.

Of course, effective creosote treatment depends on the method of application. There must be careful scientific control at every step in the pressure treating process. During application, the preservative must be measured by precise equipment as it is forced into the wood. Final retention, distribution and concentration must be checked continually to assure the buyer of the best possible product. *This is the type of treatment that you get from Amcreco.*

If you've never been an Amcreco customer or if you've never profited by our years of experience and strategically located treatment plants and sales offices, contact us on your next job. We would appreciate an opportunity to quote your needs.

AMERICAN CREOSOTING CORPORATION

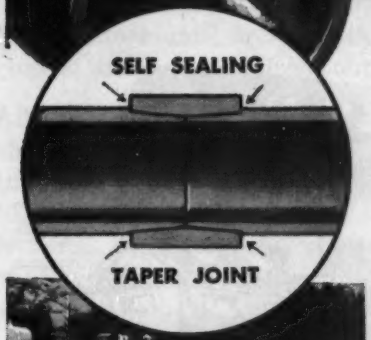
Colonial Creosoting Company
Federal Creosoting Company
Indiana Creosoting Company

AMCREO
LOWRY PROCESS

Gulf States Creosoting Company
Georgia Creosoting Company
Kettle River Company

GENERAL OFFICES: LOUISVILLE 2, KENTUCKY

SMOOTH BORE!



Orangeburg Fibre Conduit Prolongs Cable Life

Protect cable sheath from abrasion and you prolong the life of underground cables, say utility engineers. Scoring of cable sheath creates "trouble spots" that shorten cable life.

That's where Orangeburg Fibre Conduit plays an important part in keeping cables healthy. Orangeburg's smooth bore, its low coefficient of friction minimize the danger of abrasion when cables are pulled in, as well as later on during cable movement. By protecting cable sheath from abrasion, Orangeburg Fibre Conduit adds years to cable life.

Orangeburg's impermeable wall and watertight joints protect cables from corrosive ground waters. Its nonmetallic material is strong, tough, resilient, long lasting.

And, remember, Orangeburg lays faster and at lower cost than other types of conduit. It is light in weight, easy to handle, easy to tool on the job. Spacers, bends, fittings, 5° bend sections and lightweight tapering tool, all combine to simplify installation.

Since 1893, records of long life have proved Orangeburg's durability and economy.

Orangeburg Fibre Conduit is distributed by Graybar Electric Company and General Electric Supply Company with branches and stocks in principal cities.

WRITE DEPT. EW-17 FOR NEW CATALOG 52.

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y. West Coast Plant, Newark, Calif.

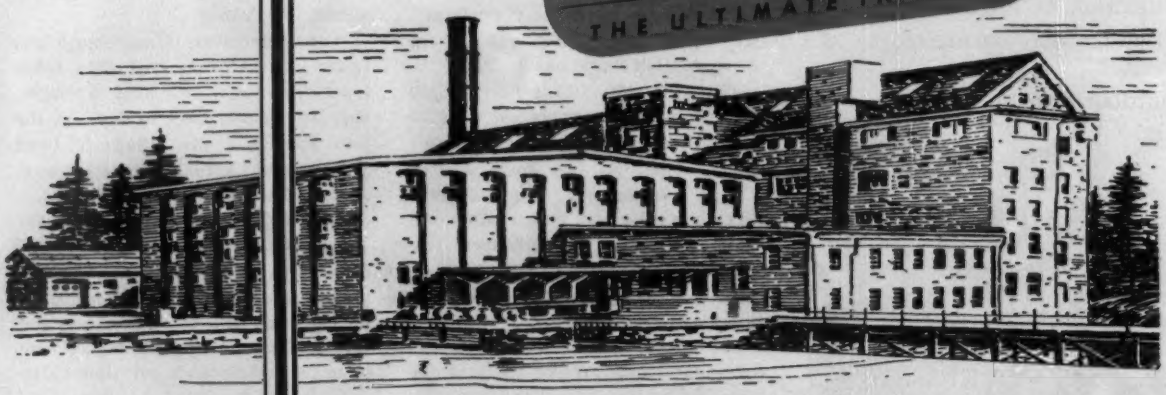
ORANGEBURG®
FIBRE CONDUIT

THE ULTIMATE IN MICA

You know that Mica is a natural product—
that it must be processed into usable form—
that who does the processing
and how is important—
When Mica is specified, go all the way
and specify

MACALLEN MICA
THE ULTIMATE IN MICA

send for Catalog



THE MACALLEN COMPANY

BAY ROAD
NEWMARKET, NEW HAMPSHIRE

CHICAGO: 565 W. WASHINGTON BLVD.
CLEVELAND: 1231 SUPERIOR AVE.

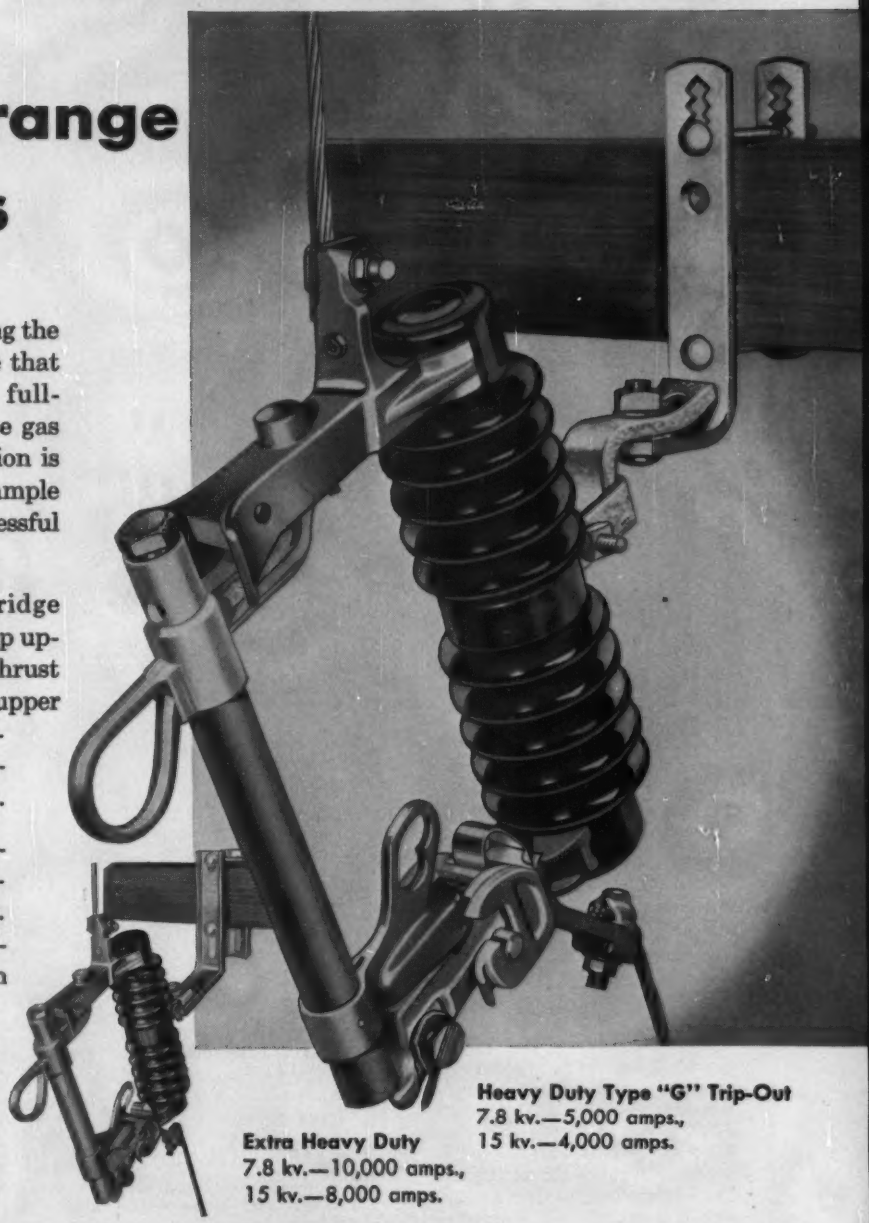
KEARNEY
Type "G" TRIP-OUT Design

assures full-range interruptions

It's the original method of venting the gasses at the top of the cartridge that does it . . . plus the exclusive full-floating upper contact! Adequate gas relief for high current interruption is provided by the top vent—yet ample pressure is developed for successful expulsion on low-fault currents.

During arc interruption, cartridge recoil from top gas jet acts to keep upper contacts closed. Cartridge thrust is absorbed by the full-floating upper contact (patented) which *maintains* contact until arc is extinguished and cartridge drops out.

All cartridges are interchangeable, and marked for quick identification of interrupting rating. Ratings and performance *field-proved* . . . at KEARNEY's own outdoor Substation!



Heavy Duty Type "G" Trip-Out
7.8 kv.—5,000 amps.,
15 kv.—4,000 amps.

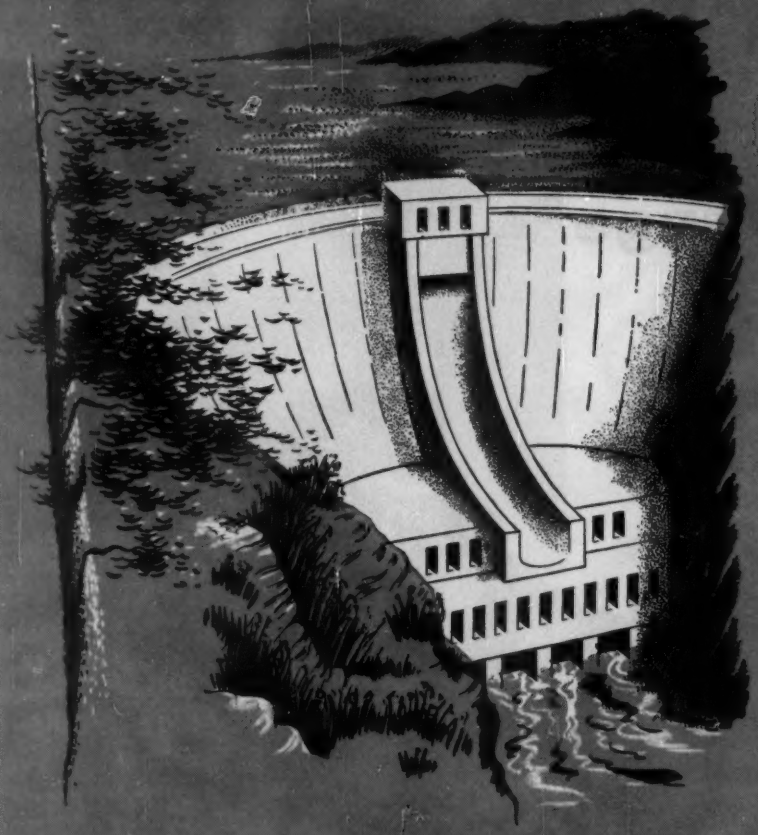
Extra Heavy Duty
7.8 kv.—10,000 amps.,
15 kv.—8,000 amps.

JAMES R. KEARNEY CORPORATION
General Offices:
4224-42 Clayton Ave.,
ST. LOUIS 10, MO.

349

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify KEARNEY PRODUCTS
The Mark of Quality

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IOWA—GUELPH, ONT., CANADA



FERRANTI

Transformers for Hydro-Electric Schemes

As specialists in the manufacture of transformers for more than 65 years, FERRANTI LTD. have been associated with many of the world's largest hydro-electric schemes.

More recent achievements include contracts for over 4,000,000 kVA of large high voltage power transformers, among which are :-

CENTRAL AFRICA

Two 120,000 kVA and six 60,000 kVA 330,000 volts three-phase Transformers have been ordered by the Central African Federation Power Board for the Kariba Hydro-Electric Scheme. This is the largest overseas transformer contract ever to be placed in the United Kingdom.

CANADA

Seven 71,000 kVA, 301,400 volt single-phase Ferranti generator transformers and six 37,000 kVA, 275,000 volt step-down Ferranti transformers have been ordered by the Aluminum Company of Canada Ltd. for the Alcan Project at Kemano and Kitimat, British Columbia. Four of the generator transformers and all of the supply transformers are now in commission.

U.S.A.

GARRISON DAM PROJECT Nine 33,333 kVA, 230,000 volt single-phase Ferranti transformers forming three 100,000 kVA banks have been supplied to the U.S. Army Corps of Engineers for the Garrison Dam Project, North Dakota.

McNARY DAM PROJECT Six 56,000 kVA, 230,000 volt, single-phase transformers have been ordered by the U.S. Army Corps of Engineers for the McNary Dam Project, Oregon.

DALLES DAM PROJECT The contract covers eighteen 63,000 kVA, 230 kV and three 63,000 kVA, 115 kV, single-phase transformers for the U.S. Army Corps of Engineers Dalles Dam Project, Columbia River.

NEW ZEALAND

Twenty-six Ferranti large power transformers have been ordered by the State Hydro-Electric Department of New Zealand. Thirteen 14,800 kVA, single-phase, 50 cycles, 11/220 kV transformers have already been supplied to Roxburgh Thirteen 9,259 kVA, single-phase, 50 cycles, 11/220 kV transformers for Whakamaru are under construction.

INDIA

Three Ferranti 20,000 kVA, OFB, 3-phase, 50 cycles, 132/33-66 kV transformers with on-load tap changing gear and two Ferranti 10,000 kVA, ON/OB, 3-phase, 50 cycles, 132/33 kV transformers with on-load tap changing gear have been supplied for the Damodar Valley Power Scheme in India.

FERRANTI LTD · HOLLINWOOD · LANCS
London Office: KERN HOUSE, 36 KINGSWAY, W.C.2.

An important message from Southwire about aluminized steel wire

FOR ACSR CORES, GUY STRAND, MESSENGER AND GROUND WIRES, TELEPHONE AND STATIC WIRES

SOUTHWIRE is proud to be among the first in the industry to offer *aluminized steel wire** in our full line of steel wire products. To electric and telephone systems plagued with costly rust and corrosion problems, this new product offers added protection at substantial savings. Here are the facts:

Laboratory tests indicate Aluminized Steel compares most favorably in corrosion resistance to Class B Zinc coated steel wire.

Field tests indicate Aluminized Steel is equal or superior in holding or slippage characteristics to galvanized strand.

Aluminum oxide protection retards penetration of most corrosive media.

It offers electrochemical protection in the event that the coating should become nicked or pierced.

Aluminized strand can be stretched or sagged with the same tables as for comparable galvanized strand.

Wherever salt air or industrial atmospheric conditions present a rust or corrosion problem, SOUTHWIRE Aluminized Steel Wire products warrant your serious consideration. Our representatives will be glad to discuss the matter with you, or your inquiry will be welcomed at our plant.

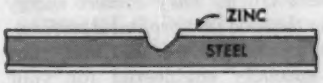
*Acco Aluminized

TErrace 2-6311 CARROLLTON, GEORGIA

"HOT-DIP ALUMINUM COATED"

ELECTROCHEMICAL PROTECTION OFFERED BY ALUMINIZED WIRE

Should the coating become nicked or pierced, exposing a small area of steel, the position of Aluminum in the Electromotive Force Series of Elements in relation to iron or steel is such that slow and long-range Anodic protection is afforded.



Zinc to steel galvanic action is similar to that of aluminum to steel; however, since zinc oxide is far more readily soluble by the elements, the zinc coating is rapidly sacrificed.

● Derrick and digger are unaffected by ground obstacles. Suspending the digger from the winch line, the full length of the derrick is utilized for reaching over this fence.

● Equipped with a Tel-E-Lect FLD (Fold Over Derrick Storage Kit) this truck can be readied automatically for work or for over-the-road travel in a few minutes.

Power IN THE STRETCH!

TEL-E-LECT...takes it out from under the hood...puts it into the ground

● **Unleash any power-packed TEL-E-LECT-equipped utility truck** and you have a real tiger for digging pole holes, regardless of soil conditions. Tel-E-Lect products are designed to get the most out of your present truck. *They convert energy under the hood into profitable performance on the ground.* Because they are specially engineered for your kind of work, you can do a better job and do it faster and cheaper!

● **Reachability:** Tel-E-Lect equipment works from any angle . . . up hill, down hill, across fences and over other obstacles. Digger-derrick units can be readied for work in two minutes and with complete safety; no legs to set, nothing to assemble. Move a single lever and the digger is ready to work.

● **Mounts on any Truck:** "A" or "T" frame *Self-Storing* derricks for either front or rear operation are available for most popular trucks. Your own mechanic can convert your truck into an efficient, profitable utility rig in a few hours.

Consult your local phone directory for the nearest Tel-E-Lect distributor or write:

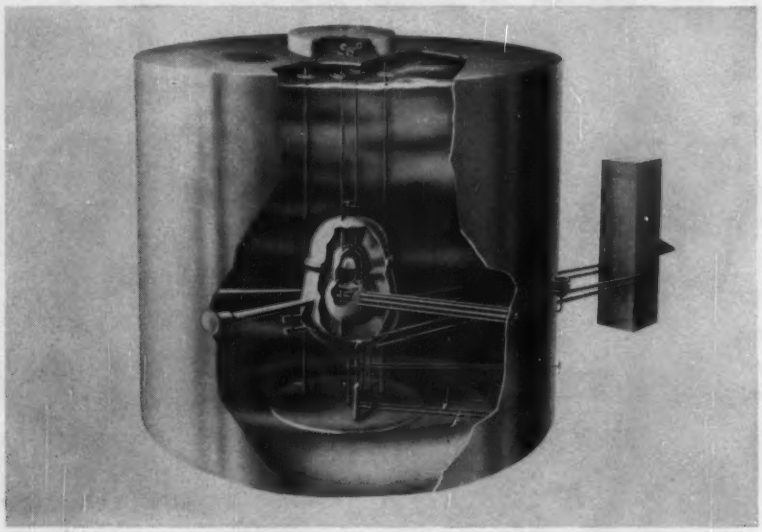
TEL-E-LECT
PRODUCTS, INC.
10003 MINNETONKA BLVD.
MINNEAPOLIS 26, MINNESOTA

Manufacturers of Winch & Digger Drive Systems ● Mechanical and Hydraulic Derricks ● Derrick Storage Kits ● and Utility Truck Bodies

NUCLEAR NEWS FROM ATOMICS INTERNATIONAL

One-man Laboratory Reactor designed for industry, hospitals and schools—available for $55,000*

A new atomic tool that will speed and broaden nuclear research and training has been designed and developed by ATOMICS INTERNATIONAL. Here is a low cost instrument that even a moderately-budgeted hospital, industrial or educational laboratory can use to teach and conduct research in nuclear science.



New Laboratory Reactor provides a neutron flux of 10^8, a gamma ray flux of 10^6.

The Laboratory Reactor (LR) is a 5-watt, solution-type nuclear reactor. It can be operated and maintained by one person. It is 8-feet high, 8-feet in diameter. Power requirements are 110-volts at 60 cycles. It is completely fabricated at the factory and shipped as a unit—manufactured and installed in about 6 months. It has a wide range of applications.

As a laboratory instrument for research programs, the LR permits qualitative analysis by the neutron activation method—including measurement of coatings on metals, moisture testing, and liquid level monitoring. It will produce more than 100 different radioisotopes, about 40 of which have half-lives short enough to eliminate the need for costly contamination controls and waste handling systems.

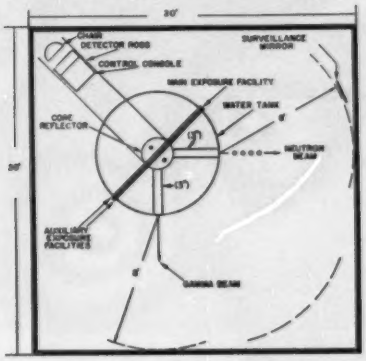
The LR can perform medical research functions such as genetic mutation studies, tracer research on plants and animals, radiation chemistry, and testing by the danger coefficient method. Equipped with facilities to conduct several experiments simultaneously, the reactor is ideally suited as a teaching tool in nuclear engineering, nuclear physics, radiochemistry and radiobiology. The basic behavior of neutron chain reactions, response to control elements, and the effect of delayed neutrons are a few of the 40-odd experiments that can be performed on the Laboratory Reactor.

The core of the reactor is a stainless steel sphere with an overhead convection recombiner. The fuel is uranyl sulphate enriched in uranium 235. The core is enclosed in a 6-inch lead reflector-shield. The complete 3500-pound unit—32" high, 24" wide—is centered in an 8-foot tank filled with water which serves as a biological shield.

The gas recombining system is contained in the core tank. A cylindrical screen above the core solution holds platinized alumina catalyst pellets which recombine hydrogen and oxygen gases formed during reactor operation. These fission product gases—valuable in experimental programs—can be withdrawn from the core through special gas lines.

The LR operator handles all controls and detection equipment from a control console adjacent to the reactor. Two cadmium control rods move vertically through the core—driven by electric motors manually controlled by the operator. The lead-weighted rods are attached to an electromagnet which releases automatically to let the rods fall by gravity into the core and shut down the reactor in event of a scram.

Instrumentation provides safety, low-cost and flexibility. At startup, three boron-lined neutron counters are fully inserted in detection tubes in the water tank. As power level increases, the operator withdraws the counters. Rate circuits—adjusted in response time constants—provide two ¼-second circuit channels for safety and observation and one 2-second channel for accurate power recording.



The LR can be installed in a 20x20-foot floor area.

ATOMICS INTERNATIONAL, a division of North American Aviation, Inc., is a major reactor builder—experienced in the design, construction and operation of nuclear reactors for research and the production of power. If you are interested in the LR—or any phase of reactor development—ATOMICS INTERNATIONAL is staffed and equipped to serve you. Please write, Director of Technical Sales, Dept. EW-71, ATOMICS INTERNATIONAL, P.O. Box 309, Canoga Park, California. Cable address: ATOMICS.

*F. O. B. LOS ANGELES

ATOMICS INTERNATIONAL
A DIVISION OF NORTH AMERICAN AVIATION, INC.
PIONEERS IN THE CREATIVE USE OF THE ATOM

NEWEST REASON WHY ALL TRANSFORMERS ARE NOT ALIKE

Add 10 KVA...use same mounting

Tough Formex* wire, now in all ratings, makes General Electric pole-type distribution transformers up to 10% smaller . . . simplifying "changeouts" to next higher rating.

"Changing out" transformers—that is, substituting a higher-rated unit for the old lower rating already on the pole—can be a time-consuming job. What really makes it tough is having to change pole hardware and set bigger poles for the higher rated units.

But today such installation headaches can be largely a thing of the past. For General Electric has now completed the introduction of a whole new line of pole-type transformers with smaller tank sizes.

*Reg. Trademark of General Electric Co.

Use of Formex wire cuts tank sizes

Using Formex wire instead of wire covered with bulky cotton-and-paper insulation, G-E engineers have appreciably slimmed down tank sizes. In most cases, a higher-rated unit now fits the same mounting hardware and same pole as the lower-rated unit already in place.

Take the new G-E 25-kva conventional transformer. It used to be 38 inches tall. Now it's only 34; so it fits in the same spot as a 15-kva unit hung five years ago. The new 25-kva transformer also features a mounting bracket with bolt holes drilled to match the mounting holes for 15-kva units. So there's no longer any need to drill new holes in the pole in order to substitute a 25-kva unit for a 15-kva unit.

No overnight development

The new units are no overnight development. They are the result of continual research and experimentation. General Electric first used Formex wire for high-voltage coils. Gradually Formex wire was used on low-voltage coils in a limited number of ratings. And today's new designs are the culmination of this work.

Formex Wire Gives Extra Dependability

Formex wire sets new standards for electrical and mechanical strength. The impulse strength of Formex wire, for example, is phenomenal; three mils thickness of the film insulation has *twice* the impulse strength of six mils of ordinary paper and cotton. Formex is so rugged it will withstand twisting, scraping, burning and hammering that would demolish ordinary insulation.

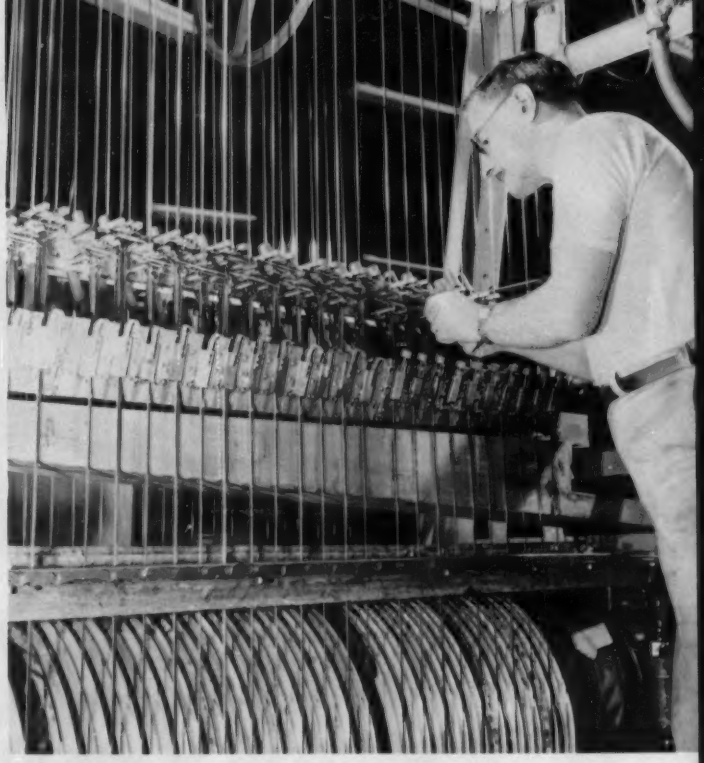
The changeover to Formex is complete for all ratings through 167 kva.

All Transformers Are Not Alike

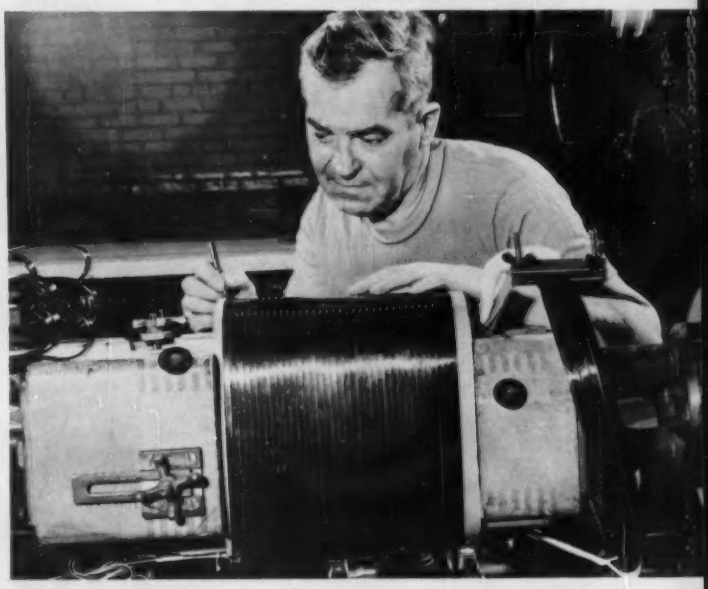
Formex wire is only one advantage of General Electric distribution transformers. Others include *impulse testing* to assure extra-long life, *one-piece clamping bands* to give superior sealing and simplify servicing, AL/CU *terminals* to assure tight connections with either copper or aluminum conductors, and many others—evidence that all transformers are *not* alike.

LIVE BETTER ELECTRICALLY

Prove to yourself how tough Formex wire is. For a sample that you can test, write to Section 431-48, General Electric Company, Schenectady 5, N. Y.



UP TO EIGHT COATS of enamel are applied to the Formex wire, and each coat is baked. Mechanically rugged, Formex wire has great electrical strength. Just 3 mils thickness of film has twice the impulse strength of 6 mils of paper-and-cotton insulation.



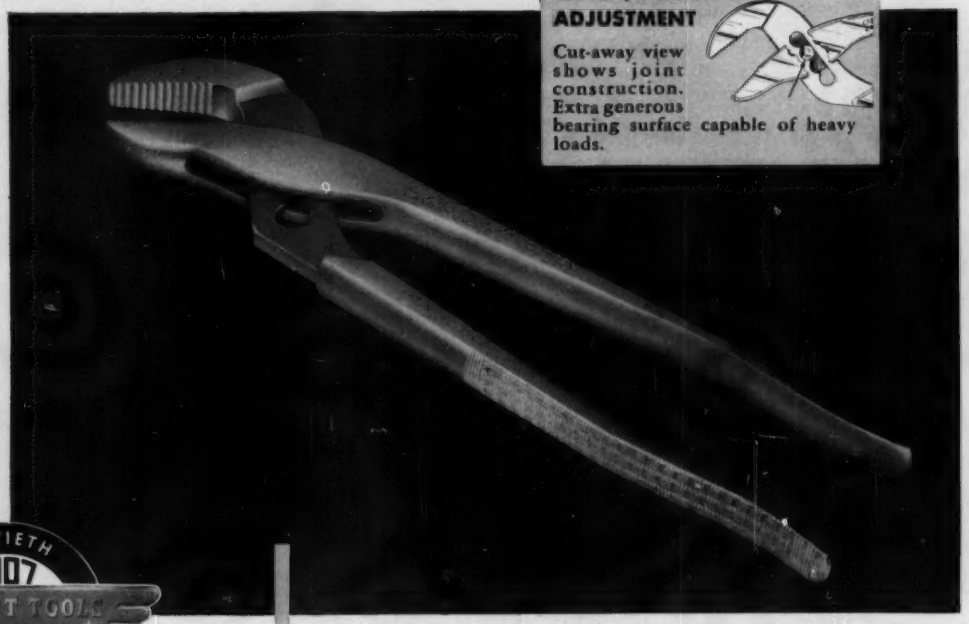
COMPACT FORMEX WIRE COILS together with improved core steel, make possible reductions of up to 10 per cent in transformer size and weight . . . yet Formex wire coils have great short-circuit strength. The result, transformers are lighter, easier to handle.

Progress Is Our Most Important Product

GENERAL ELECTRIC

"CRESTOGRIP"

A new and better Utility Plier


QUICK, POSITIVE ADJUSTMENT
Cut-away view shows joint construction. Extra generous bearing surface capable of heavy loads.

FIFTIETH 1907 CRESCENT TOOLS *Give Wings to Work* 1957 ANNIVERSARY

HALF A CENTURY OF FINE TOOLS

The Crescent Wrench, originated in 1907, is probably the most imitated hand tool in the world today. Through the years Crescent has not only improved this famous wrench but has designed many new tools to fill the needs of changing industry and specialized skills. Crescent Tools are sold by Hardware Dealers and Industrial Distributors everywhere.

CRESTOGRIP No. P210 Utility Plier should not be confused with ordinary "slip-joint" pliers. Its box joint provides twice the strength of the conventional lap joint and eliminates sideways twist and strain. It will grip flat, square, hex or round objects with powerful leverage. Adjusts to four positions up to 1½" capacity. It has no rivet projections and measures only ½" at its thickest point. Handsomely finished in rust-resistant zinc plate. Overall length, 9½".

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

Connect
COPPER with COPPER
ALUMINUM with ALUMINUM
use...

PAC-5
ACSR 6—1/0 Cu. 8—1/0

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4
6—1 0 A R Cu. 8—1 0

BLACKBURN
COPPER TO
ALUMINUM
FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORPORATION

35 MADISON STREET • ST. LOUIS 6, MO. • PHONE: MAin 1-2821

METERING DEVELOPMENTS

CLASS-200 RATING
Added to Duncan MK Line

● Another step in the completion of Duncan's line of Type MK singlephase meters is the addition of the Class-200 rating. This meter, with adequate capacity for measuring continuous loads to 200 amperes, fits in with the present trend to larger services for handling tomorrow's load. Duncan pioneered the Class-200 rating with the Type MF-SE meter, introduced over seven years ago. This new MK rating offers improved performance plus all the features of the Duncan MK singlephase line.

-joining the CLASS-100 RATING

The Class-100 general purpose MK singlephase meter is now in its third year of service to the electric utility industry. Introduction of this rating made available more KVA of metering capacity per dollar of investment —thus helping electric utilities maintain low-cost electric service.

More dependable performance is built into the MK design through the use of molded, arc-resistant insulation in the electromagnet; self-contained arc gaps to by-pass electrical disturbances; Alnico V permanent magnets to resist calibration changes; and many other design features to assure long life with low maintenance.

—and the CLASS-100 2-3 Wire RATING

The Duncan Type MK Class-100 2-3 wire rating may be used to meter either a 120-volt 2-wire or a 240-volt 3-wire service. The meter is quickly converted from one type of service to the other by moving two links—see illustrations at the right. This type of meter is particularly applicable where new 2-wire meters are needed now but would be obsoleted as soon as services are changed to 3-wire.

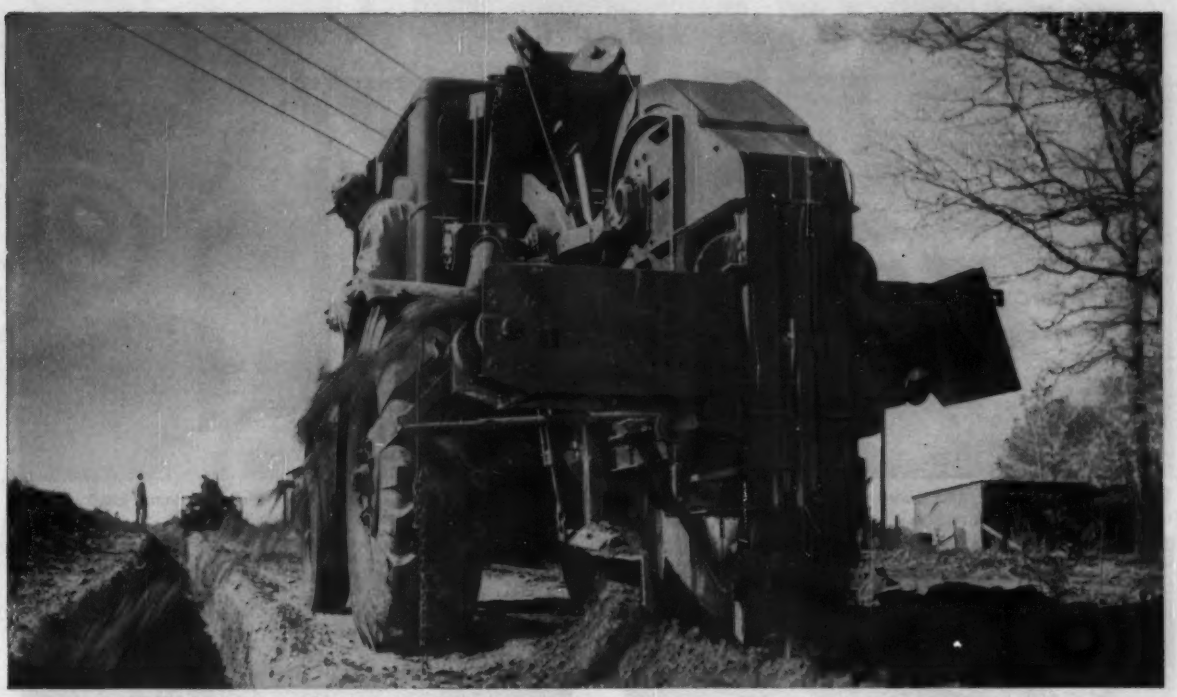
(Advertisement)

POTENTIAL LINK

Moved to the left for 120-volt 2-wire. Moved to the right for 240-volt 3-wire.

CURRENT LINK

DUNCAN ELECTRIC COMPANY, INC., Lafayette, Indiana



Model 705 Barber-Greene Runabout digs through toughest soils. High travel speed cuts time and cost of service trenching.

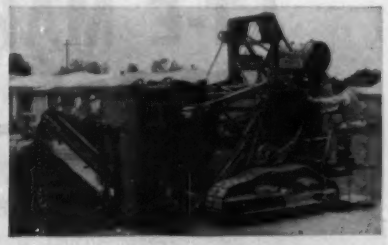
For lowest-cost trenching . . . choose the ditcher that's right for you

The first step in reducing ditching costs is to select the machine that meets your requirements. Ground conditions . . . digging range . . . job to job portability —all are factors that change with varying trenching operations. That's why Barber-Greene builds *four* distinctively different ditchers—each with special features that give it unsurpassed performance within its field.

Take the Model 705B Runabout for instance. Long a favorite for house service trenching, this versatile ditcher features the exclusive vertical boom that digs right up to obstacles leaving no ramp . . . Hydra-Crowd that gives finger-tip control of maximum crowding speeds independent of bucket line speed . . . and Fluid Coupling that eliminates shock loads.

Model 711 for widely scattered jobs. A 45 m.p.h. travel speed reduces between job time to a minimum. Digs to 5′ deep, and 18″ wide.

Model 702 for narrow trenches. A remarkably low-cost unit ideal for cable, conduit or small pipe. Digs 2¼″ to 5″ wide, to 40″ deep.



Model 44C for heavy-duty trenching. Crawler mounted for sure traction on soft bases, this Barber-Greene cuts to 8′ 3″ deep, and to 24″ wide.

56-4-D

Write for literature on any ditcher in the Barber-Greene line

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

SECONDARY UNIT SUBSTATIONS

ENGINEERED AT I-T-E and coordinated to meet the operating conditions found in your plant.

BUILT AT I-T-E with such extra features as circuit breaker test-position with doors closed.

TESTED AT I-T-E to assure ease of installation, and top performance under operating conditions.

SHIPPED FROM I-T-E to assure prompt delivery of one complete "package," ready to install.

I-T-E MAKES IT EASY TO BUY COMPLETELY COORDINATED UNITS

Only I-T-E builds transformers and switchgear in the same plant. This permits them to assume all responsibility for your unit substation requirements. Close association of engineering and production relieves you of detailed planning, paperwork, and the problems of coordinating deliveries. Shipment is from one location. Installation is speeded. Substation components are completely integrated to provide top performance at low overall cost.

Typical of the extra value which *only* I-T-E Unit Substations offer is circuit breaker test-position with doors closed—and without removing them. This means additional safety to operating personnel, greater cleanliness, simplified tagging out of circuits, and longer life. I-T-E Secondary Unit Substations can be supplied for any application, indoor or outdoor, and in any standard rating. For details, contact the I-T-E sales office nearest you. Or write I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

Now! *Reliable*

ALL-ALUMINUM SQUEEZ® SLEEVES

in all service entrance combinations

ALUMINUM - ACSR - COPPER from SIZES No. 10 to No. 2

These heavy-wall, all-aluminum *SQUEEZ* Sleeves are cleaned, greased and capped, ready for use. The colored plastic caps that code the sizes need not be removed, they are punctured by conductors. The solid center barrier locates and separates conductors and assures an even distribution of the factory added grease to all strands within the sleeves.

Fifteen sleeves,color coded and marked provide for all conductors No. 10 to No. 2.

RELIABLE NO. 10-XPJ *SQUEEZ* TOOL

For maximum versatility with minimum truck and working space, the Reliable No. 10-XPJ combines three standard die grooves in a toggle type tool.

Handles are coated with bright orange vinyl plastisol that provides insulation when used for work on secondaries. Also available with painted handles. Bright color helps avoid loss.

FREE SAMPLES Just ask for your free samples of Reliable Aluminum *SQUEEZ* Sleeves . . . they'll be sent promptly.

Reliable ELECTRIC COMPANY CHICAGO 12, ILLINOIS

POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

PAGE & HILL PUT LONGER LIFE IN POLE LINES

From Page & Hill research come the secrets of longer pole life . . . preservative formulae, methods of treating, test plots, constant checking of pole lines subjected to every kind of exposure. The reward is this: Every P & H "Life-Span" Pole that was installed 15 years ago is still serving today without a sign of even mild decay! And the research continues.

For you, this means fewer replacements . . . a reduced workload for your crews . . . better service to your customers.

Of this you can be sure—"Life-Span" Western Red Cedar Poles are completely immunized against fungi and insect damage from top to butt. They are nature's best with the finest preservative protection yet developed. Clean and odorless, too.

LIFE-SPAN

WESTERN RED CEDAR POLES

BUILT BY NATURE

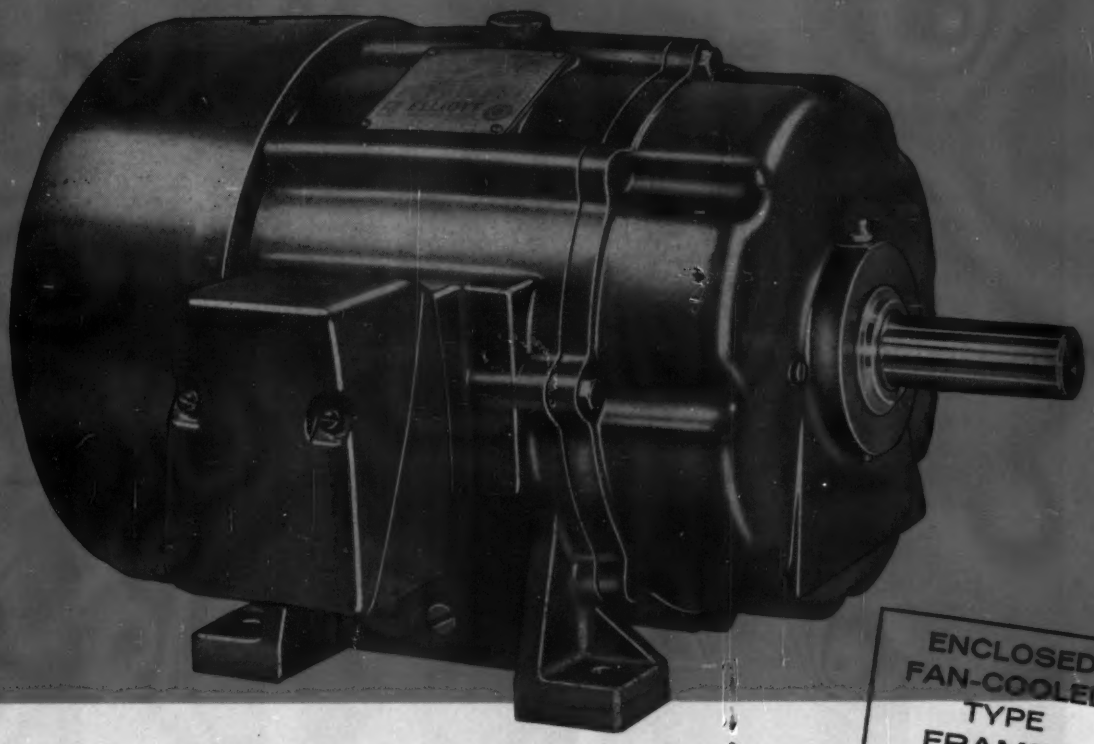
Life Span

Write today for complete information:

PAGE & HILL, INC.

MINNEAPOLIS 3, MINNESOTA

Inside and Outside . . . entirely new



ENCLOSED FAN-COOLED TYPE FRAMES 184-256U

Elliott C-W Type N Motors

NEW PERFORMANCE! You get more horsepower per pound from these compact Elliott C-W motors because of their improved design, and the use of vastly superior insulating materials and electrical steels. Due to greater mechanical and dielectric strength, insulating materials occupy less space. More space is available for copper—the "muscle" of the motor.

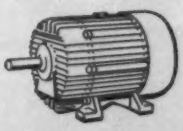
NEW PROTECTION! Internal parts of Elliott C-W motors are completely protected by rugged housings—dripproof, or totally-enclosed, as required. Efficient fans assure ample cooling.

NEW DEPENDABILITY! New Elliott C-W type N motors are designed for the utmost in dependability. They will withstand physical abuse. Use of highly dependable insulating materials assures prolonged life; anti-friction bearings are available in several optional types, to meet severe service conditions.

OTHER C-W TYPE N MOTOR ENCLOSURES

Totally-enclosed non-ventilated

Dripproof Protected



Totally-enclosed, fan-cooled (ribbed frame)

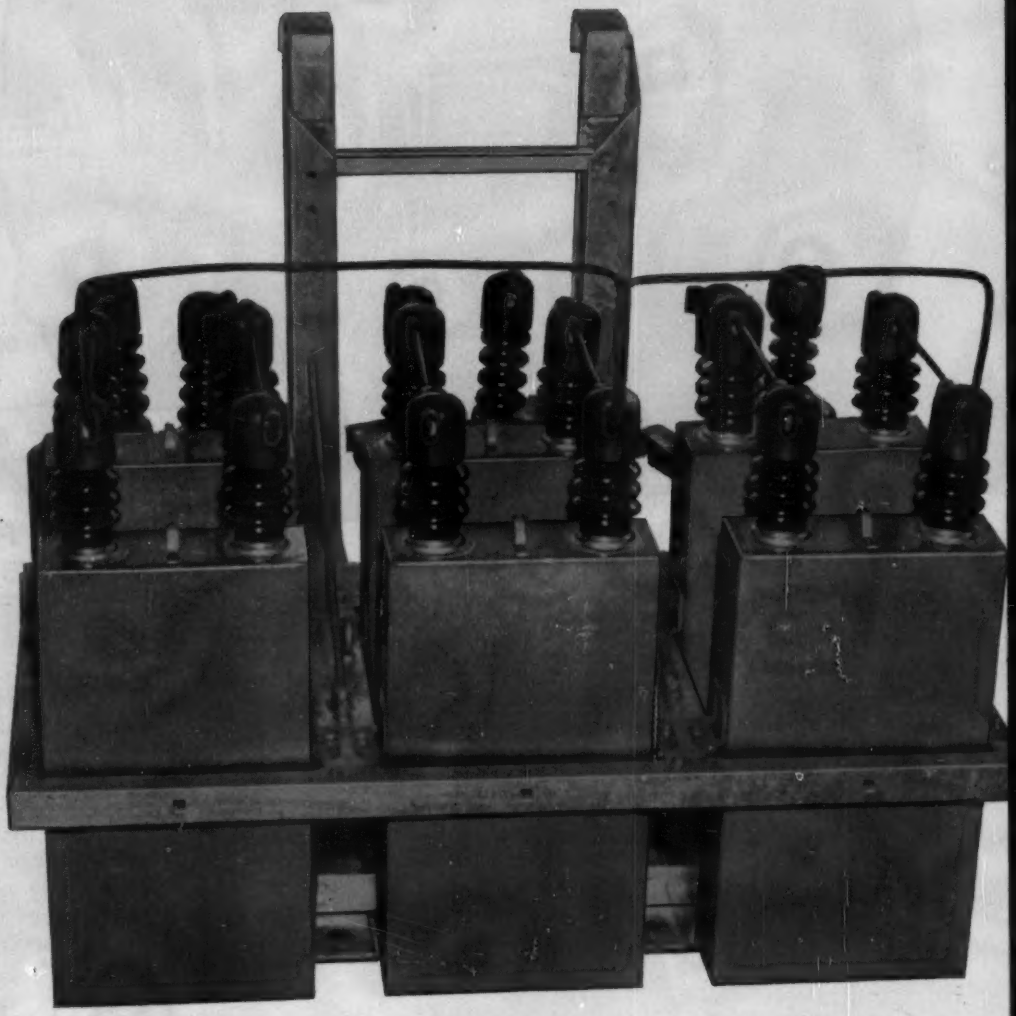
ELLIOTT Company

CROCKER-WHEELER DIVISION

WRITE for new bulletin describing Elliott C-W Type N Motors. Address: Elliott Company, Crocker-Wheeler Division, Jeannette, Pa.

W6-4

Big things come in sm



aller packages from TOBE

IN SOME BUSINESSES, the bigger the package the bigger the sales. People say *"bulk it up . . . make it look big"*. Our business is different. *"Shrink it"*, we say. Our engineers are experts at making capacitors smaller in everything but performance. The TOBE 50 KVAR power capacitor is a case in point. As a result of TOBE's progressive engineering design, rigid production controls and test procedures, this 50 KVAR delivers twice the KVAR rating in only 40% the size and weight. That is why it will pay you to investigate the new line of TEMPALL POWER CAPACITORS.

TOBE TEMPALL CAPACITORS *also feature:*

- TOBE control procedures which assure thermal stability;
- Self-locking neoprene terminal cap*
- More correction for less dollars because of TOBE's low losses. This too means higher capacitor efficiency.
- Only TOBE gives you lowest initial cost, lowest operating cost, lower maintenance cost.

Available in all standard ratings. In single units, racks, pole assemblies and complete cabinets ready for field installation and energization. Write to Tobe Deutschmann Corporation, Norwood, Massachusetts, or phone Norwood 7-2620, collect for further information today.

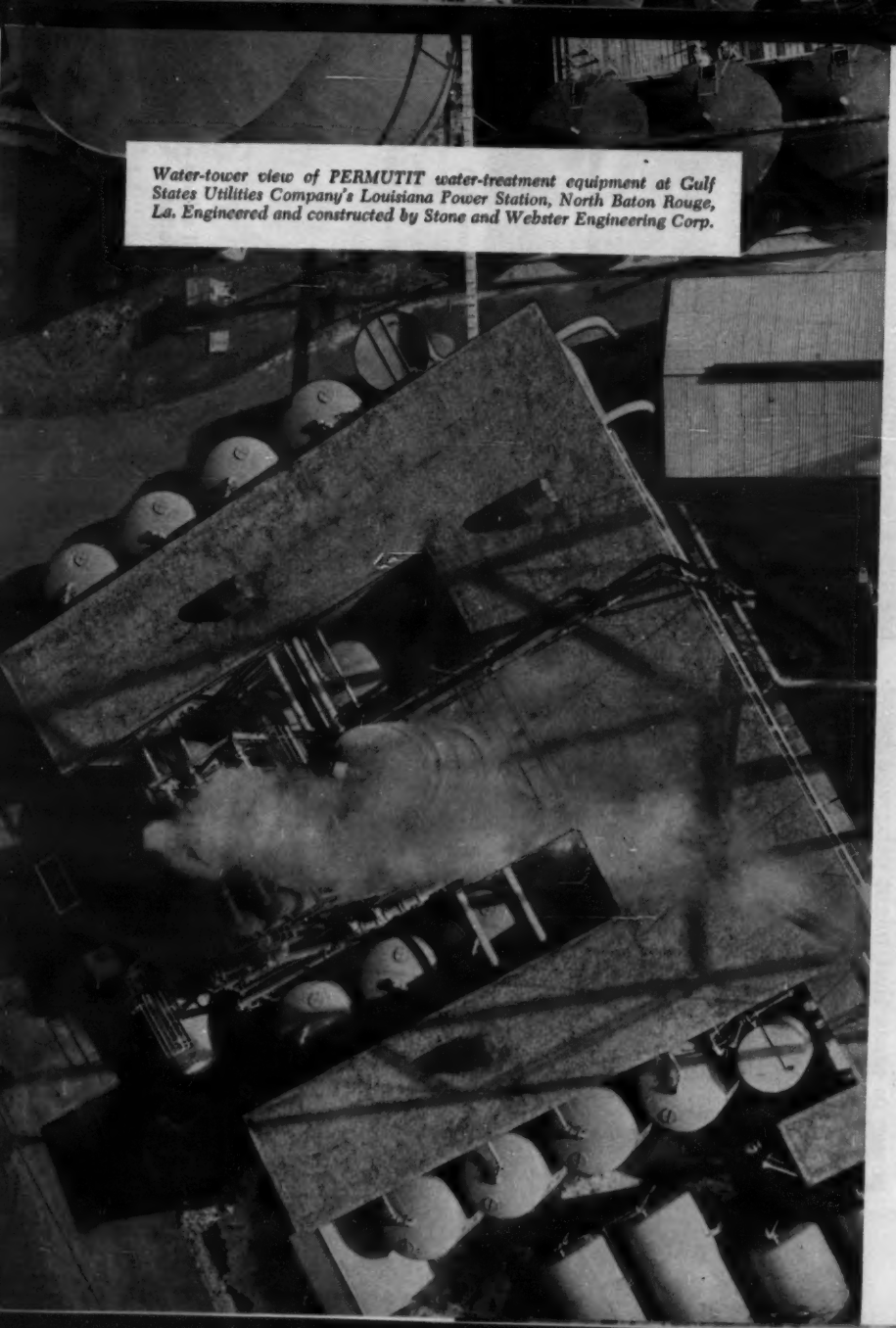
LOOK TO TOBE FOR PROGRESS

Since 1929 persistent research, trustworthy engineering, rigid production standards.

TOBE

TEMPALL CAPACITORS

*PATENT PENDING

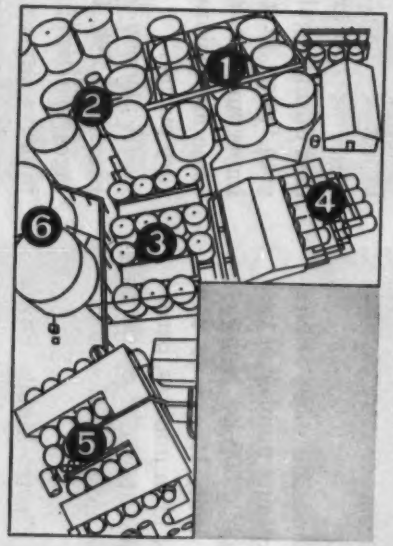


Water-tower view of PERMUTIT water-treatment equipment at Gulf States Utilities Company's Louisiana Power Station, North Baton Rouge, La. Engineered and constructed by Stone and Webster Engineering Corp.

12 million gallons of make-up per day

This station needs a *large volume* of water because it sells its steam to a refinery for process and requires 100% make-up. It needs *high-grade* water because it has adopted high-pressure boilers and turbines. It needs *efficient* treatment because it uses muddy Mississippi River water and well water with high solids and silica.

HERE'S HOW THIS 26-YEAR OLD PLANT HAS KEPT UP TO DATE *(see diagram):*



1. Original *batch coagulation and settling tanks.* Some are still used for secondary treatment of river water to reduce silica.

2. The 1931 roughing sedimentation tanks were converted to modern up-flow *Precipitators* in 1938 . . . cutting hardness 20%, turbidity 40%—and tripling capacity.

3. *Gravity filters* polish the clarified river water prior to softening.

4. Old Zeo-Dur® *zeolite softeners* were converted to new Zeo-Karb® exchanger in 1937 . . . boosting each unit's capacity 55%.

5. *Demineralizers* for new high-pressure boilers were added in 1955. They treat 3500 gpm, reduce dissolved solids of well water from 271 to under 2.0 ppm and silica from 25 to less than 0.1 ppm. Completely automatic PERMUTIT controls determine end-points, rinse, backwash and regenerate units and return them to service . . . even prepare regenerating solution.

6. *Tanks* store the high-quality, low-cost demineralized feedwater.

Whether you need one piece of water-treatment equipment . . . or acres of it, PERMUTIT has the know-how . . . earned by experience. This knowledge is at your service. Write The Permutit Company, Dept. EW-1, 330 West 42nd Street, New York 36, N. Y. or Permutit Company of Canada, Ltd., Toronto 1, Ont.

PERMUTIT®
WATER CONDITIONING
Equipment • Resins • Experience

Demineralizers • Zeolite and Hot-Process Softeners • Dealkalizers • Deaerating Heaters • Pressure and Gravity Filters • Chemical Feeders • Aerators • Blow-off equipment • CO_2 Indicating Recorders • Zeolites and Resins • Instrument Panels • Control Cubicles.

An answer for every electric utility

A PLANNED OUTAGE IS NO OUTAGE

Five hundred kw is not a large unit of power by utility standards. Not, that is, unless it is badly needed . . . and not available.

That's why more and more utilities are finding an increasing number of uses for the Electro-Mobile 500 kw highway-trailer generating unit. It can go anywhere, pick up a load in minutes, permit construction or maintenance crews to work without interrupting service to customers.

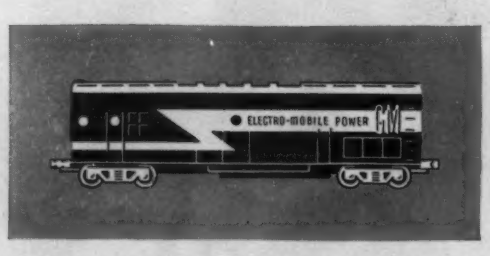
In addition, Electro-Mobile Power offers an immediate source of emergency power to areas that might otherwise be without service for a long period of time. Used in multiple, there is no limit to the amount of power these units can supply.

The savings from Electro-Mobile Power are many. Rebuilding or maintenance work of any duration can be handled during regular working hours. Work goes faster, in greater safety, and most important—customer relations and income are maintained during the temporary outage.

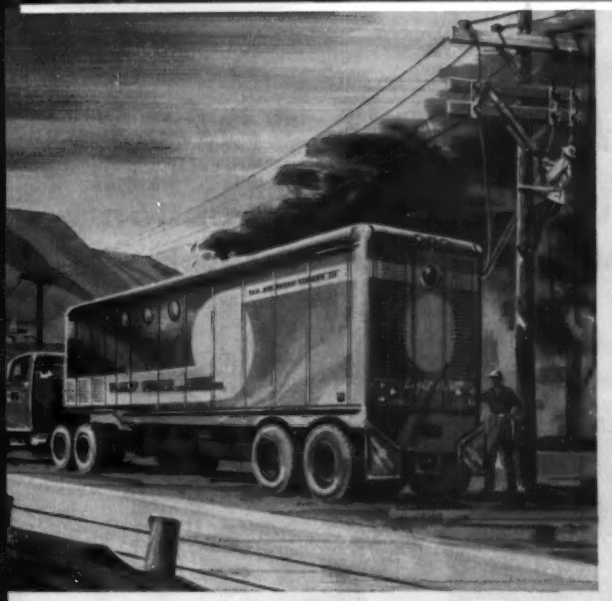
A planned outage is no outage with Electro-Mobile Power. Its many advantages are helping to reduce costs and improve service for many utilities. It can do the same for your system. Your Electro-Motive representative will be glad to show you how.

Here's how one Midwestern utility company uses its Electro-Mobile trailer . . .

In a span of twelve months, this utility used its Electro-Mobile trailer on fifteen different jobs. Shown here are some examples of the work completed and in progress with this unit. During the year the mobile trailer was operated over 340 hours. On one job alone, it was used 145 hours, delivering 58,500 KWH.



Rail Car—develops 1,000 kw. For use on rail sidings or placed on piers for semi-permanent installation.



Relocating 12,400-volt line for new highway.
Hours used: 68 ¼ KWH generated: 22,700

Installation of new transformer for substation.
Hours used: 3 ½ KWH generated: 1,100

Feeding 12,400-volt sub-transmission line while stringing new conductors on transmission line.
Hours used: 145 KWH generated: 58,500

Handling daily peaks while existing transmission line and substation are being rebuilt.
Hours used: daily average 4

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS
LA GRANGE, ILLINOIS

Sales Offices in Chicago, New York, St. Louis, San Francisco

Why be half safe?

Specify AUTO-SPEED interruption . . . 3E Air Interrupter Switches

Howard Shatzer, 3E field engineer, checking an Air Interrupter Switch before shipment.

What is **Auto-speed interruption** . . . an automatically produced interruption that always occurs at the same point in the switching operation, and always takes the same time (one-half cycle). Human error is eliminated from the switching action by a trigger spring mechanism which trips the switch at a pre-set point. Contacts are separated inside a dry type interrupter unit.

Specify safety for personnel and equipment. No exposed Arc. 3E Air Interrupter Switches will not produce external arcing dangerous to men or equipment.

Specify economy Costing less than circuit breakers and with interrupting capacity not found in air break disconnects, 3E Air Interrupters are ideal for . . . interrupting magnetizing charging current of transformers . . . interrupting charging current of lines and busses . . . interrupting exciting current of feeder regulators . . . interrupting load currents to rated capacity . . . sectionalizing feeders and distribution circuits.

Specify Engineering Ability 3E's staff of engineers is experienced in adapting or combining equipment for complete switching centers or additions to existing units. Designing for unusual needs . . . corrosive or dusty atmospheres, unique space requirements, portable units, or carefully calculating tomorrow's expansion requirements . . . we are geared to handle the unusual.

Howard Noble, 3E Sales Promotion Mgr., demonstrates Air Interrupters in a complete cubicle installation.

Write for Bulletin 152

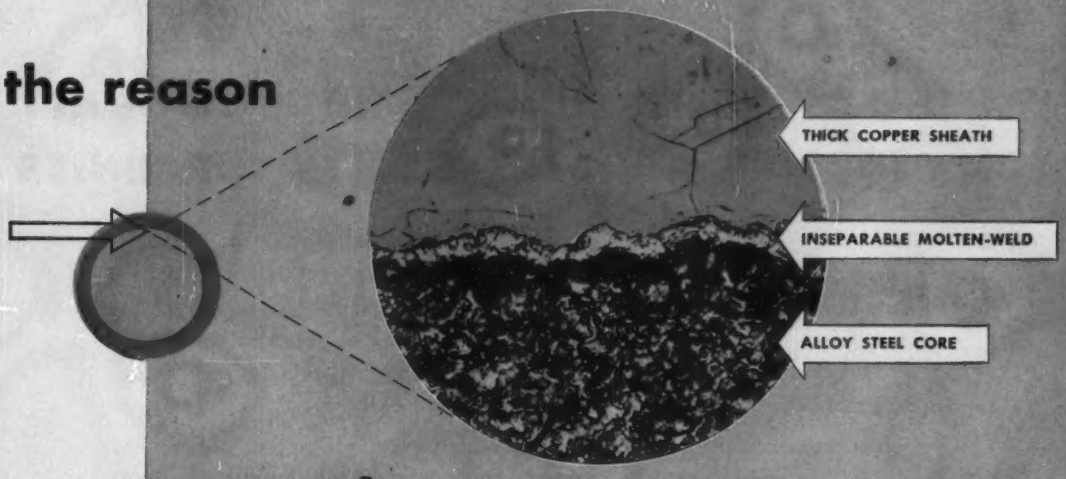
3E Air Interrupter Switches are made in ratings up to 15 K.V.

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois

Representatives in principal cities—in Canada by Power-Lite Devices, Ltd.

The molten-weld

is the reason


(microphotograph shows weld area of Copperweld Wire, greatly enlarged)
THICK COPPER SHEATH
INSEPARABLE MOLTEN-WELD
ALLOY STEEL CORE

for the dependability • economy • long life of Copperweld products

Only Copperweld* is molten-welded—an exclusive process which permanently interlocks copper and steel, uniting them so strongly that they cannot be separated. This molten-weld is the reason Copperweld Products are different and better—performing as a single material which combines the conductivity and rust-resistance of copper with the strength of steel.

You're SAFE when you use Copperweld. It pays off in dependable and economical performance.

*Trade Mark

COPPERWELD STEEL COMPANY WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

CONDUCTIVITY — STRENGTH — PERMANENCE

PROVED IN SERVICE FOR OVER 40 YEARS

FOR THE POWER INDUSTRY: guy strand • ground rods and clamps • anchor rods
power conductors • weatherproof wire • messenger strand
overhead ground wire • counterpoise wire
pole grounding wire • tie wire

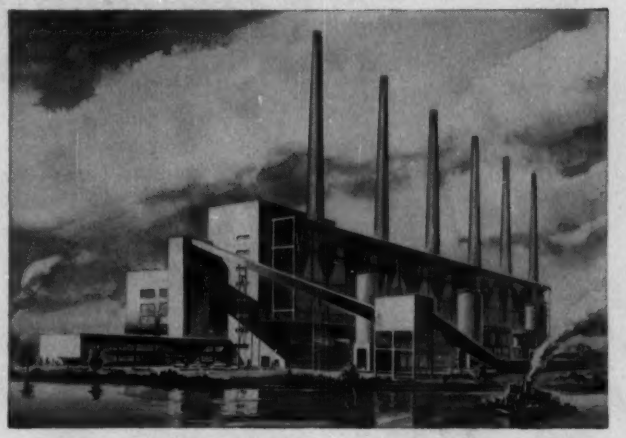
Write for your copy of the Copperweld Engineering Handbook

"BUFFALO" FANS SUPPLY INDUCED DRAFT FOR WORLD'S LARGEST GENERATOR UNITS

Shown here is one of four "Buffalo" Double Inlet I. D. Fans serving the boilers for the world's largest turbine units. Rated at 260-Mw each, one of these two turbine-generators is operating at the River Rouge Plant of the Detroit Edison Company.

Frequent selection of "Buffalo" Draft Fans by leaders like Detroit Edison speaks volumes for the dependability and efficiency designed into these fans. We call it the "Q" Factor, the Built-in Quality which provides trouble-free satisfaction and long life.

"Buffalo" Draft Fans are designed for *modern* power plant requirements — in choice of backward curve, airfoil, radial and forward curve types — to provide the best fan for any operating conditions. Write or phone your nearest "Buffalo" Engineering Representative for recommendations on the best fans to meet your operating conditions.



Proposed 6-unit River Rouge Plant of Detroit Edison Company.

"Buffalo"

BUFFALO FORGE

BUFFALO,

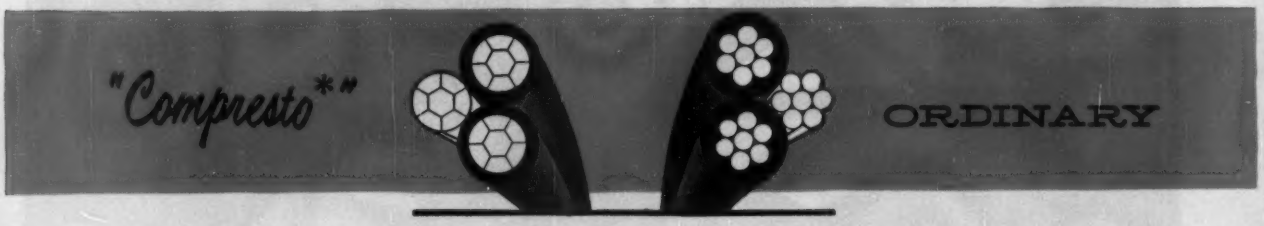
Canadian Blower &

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT

COMPANY
NEW YORK
Forge Co., Ltd., Kitchener, Ont.
EXHAUSTING
FORCED DRAFT
COOLING
HEATING
PRESSURE BLOWING

"Compresto*Cable" WEIGHS LESS!

INCREASES SAFETY FACTOR IN ICE AND WIND LOADINGS!



TRIPLEX

Compresto* Triplex weighs less because the wire strands are compressed to a smaller diameter. Yet, Compresto has the same aluminum area and conductivity, and the same dielectric protection as ordinary cable! Reduces ice and wind loadings because it's smaller, yet just as strong!

EXAMPLE OF COMPARATIVE SAG AND TENSION DATA

ON #4 TRIPLEX S. S. SERVICE DROP CABLE ● 2 PHASE WIRES 7-STRAND ALL ALUMINUM
1 NEUTRAL 7-STRAND ALL ALUMINUM
ULTIMATE STRENGTH: 826 LBS. (BARE NEUTRAL) ● BASED ON 100 FT. SPANS
HEAVY LOADING AREA — 5th EDITION NESC — 1/2" ICE, 4-LB. WIND, K-.31

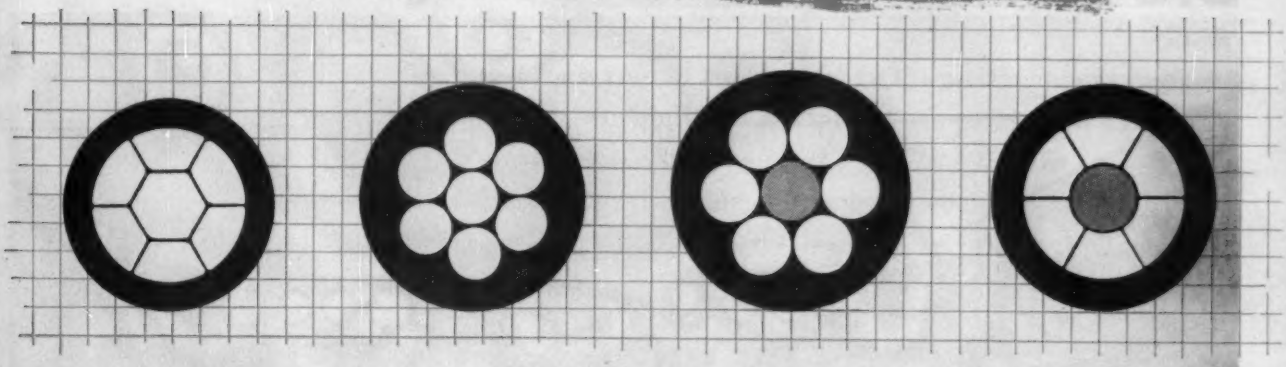
ORDINARY NO. 4 "TROUT" TRIPLEX 4/64" Neoprene Diameter of Circumscribed Circle, .714"					"COMPRESTO" NO. 4 "TROUT" TRIPLEX 4/64" Neoprene Diameter of Circumscribed Circle, .674"					"COMPRESTO" NO. 4 "OYSTER" TRIPLEX 3/64" Polyethylene Diameter of Circumscribed Circle, .576				
	INITIAL		FINAL			INITIAL		FINAL			INITIAL		FINAL	
TEMP. FAHR.	Tension Lbs.	Sag Inches	Tension Lbs.	Sag Inches	TEMP. FAHR.	Tension Lbs.	Sag Inches	Tension Lbs.	Sag Inches	TEMP. FAHR.	Tension Lbs.	Sag Inches	Tension Lbs.	Sag Inches
0	Resultant: - 413			52.1	0	Resultant: - 413			50.5	0	Resultant: - 413			46.4
0	75	43.1	71	45.8	0	66	40.8	59	43.8	0	62	36.1	57	39.2
30	72	45.4	66	48.0	30	59	43.2	56	46.1	30	59	37.4	54	41.8
60	69	47.5	64	50.0	60	56	45.4	52	48.2	60	56	38.8	52	44.0
90	66	49.6	61	52.0	90	52	47.6	51	50.3	90	52	41.2	49	46.2
120	64	51.6	59	53.4	120	49	49.6	49	52.2	120	49	43.6	48	48.4

AVAILABLE IN DUPLEX, TRIPLEX AND QUADRUPLEX!

Compresto* Cable is available in the insulation of your choice. Neoprene: processed by Western Electric Company's Improved Room Temperature Method; Polyethelene; Two Coat rubber insulated, Neoprene Jacket. Available on our no-charge, non-returnable reels, or in standard coils or packages to your specifications.**

* Registered U. S. Patent Office
** Trademark

"Compresto *Cable"



COMPRESTO* ALL ALUMINUM | ORDINARY ALL ALUMINUM | ORDINARY ACSR | COMPRESTO* ACSR

5 REASONS WHY YOU WILL WANT TO USE "Compresto *Cable"

1. Adaptable to self-supporting service drop cable, or weather-resistant service wire.
2. The result of a special drawing technique that produces a flexible conductor of small diameter, yet maintaining the full aluminum cross-sectional area.
3. Has greater contact surface area for standard connectors, assuring full physical and electrical properties.
4. Affords the ultimate in resistance to installation damage, abrasion, compression cutting.
5. Eliminates the voids of an ordinary stranded conductor, reducing the weight without reducing the insulated wall thickness.

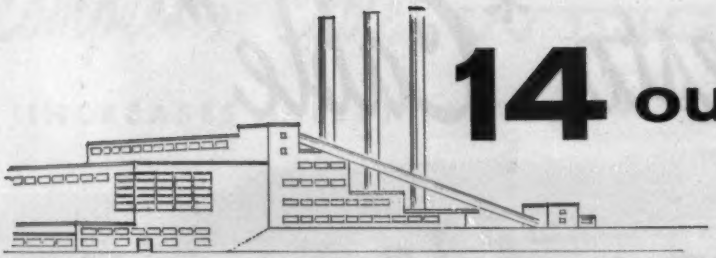
DEVELOPED AND MANUFACTURED BY

SOUTHERN QUALITY
MEETS EVERY TEST
AMherst 7-6661

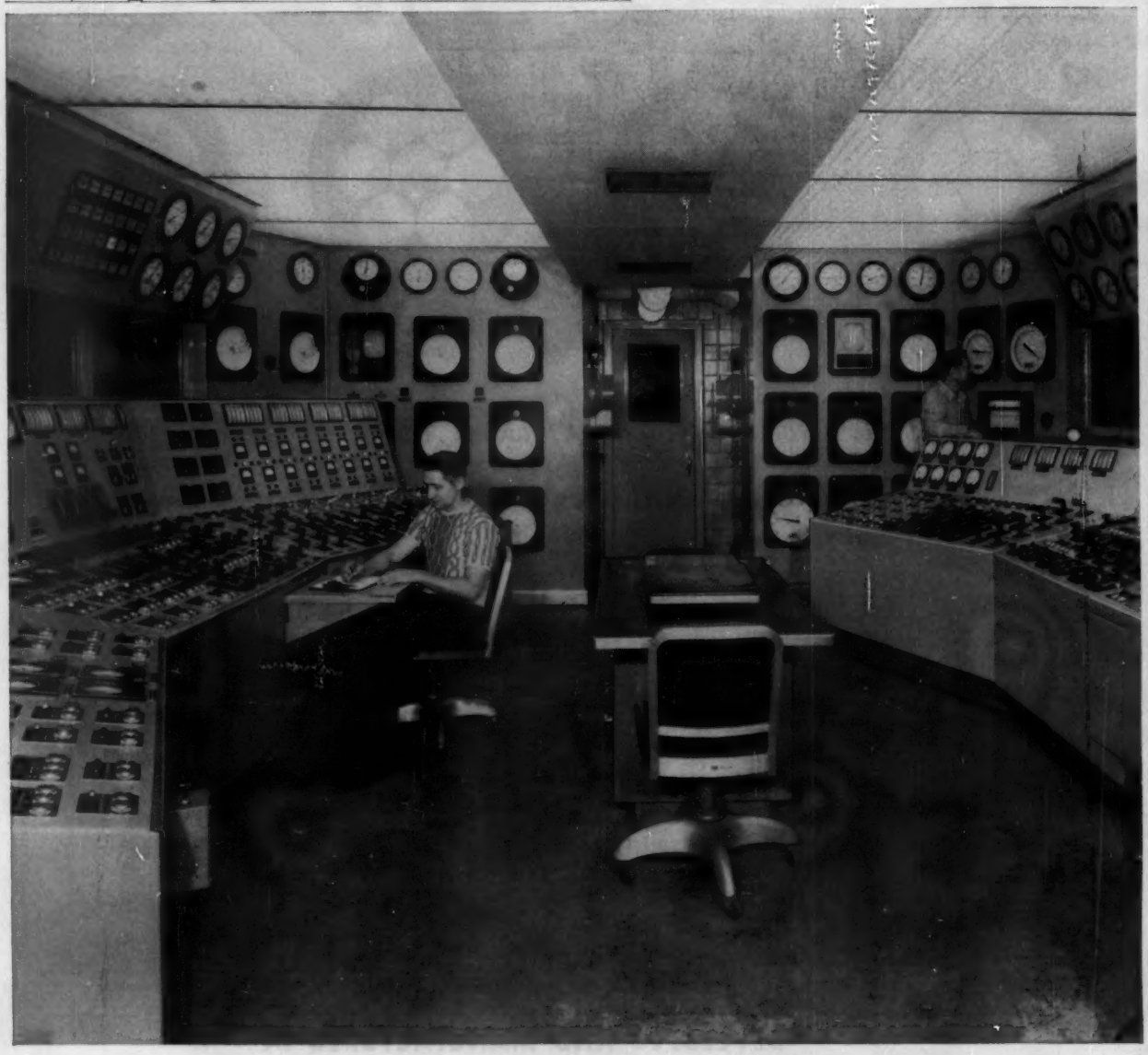
SOUTHERN SERVICE
EXCELS THE REST
P.O. Box 989

Southern Electrical Corporation

CHATTANOOGA, TENNESSEE

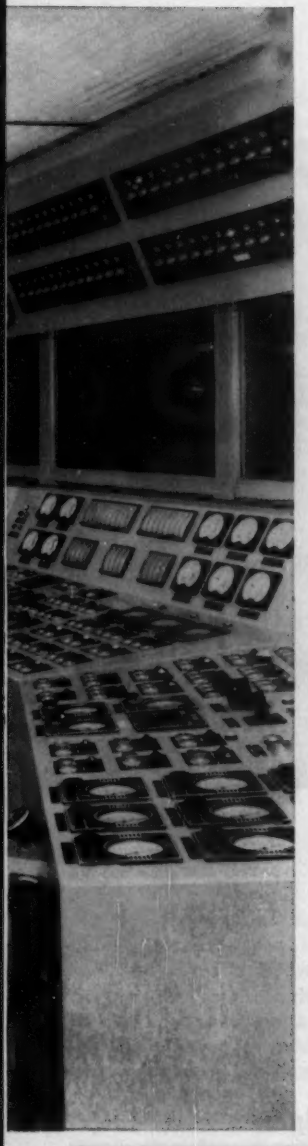


14 out of the 15



The steam control room for units 3 and 4 of the Eastlake Plant of The Cleveland Electric Illuminating Company. Eastlake uses Bailey Meters and Bailey Controls for Combustion, Feed Water and Steam Temperature. The FPC reported a 1955 heat rate at Eastlake of 9,336 Btu per kwhr, making it the seventh most efficient plant in the United States.

"most efficient*" plants use Bailey Meters and Controls



How's that for a vote of confidence! In the electric power industry, quality and dependability of equipment are paramount and 14 out of the top 15 power stations on the FPC's 1955 list chose Bailey Meters and Controls. Nine of these 15 chose Bailey equipment exclusively!

For breadth of product line, depth of experience, size and quality of field service organization, no one offers more to the power industry than Bailey. And the time to contact Bailey is during the early planning stage, when our recommendations can save time, trouble and money. Our engineers are at your service.

* 15 MOST EFFICIENT PLANTS

1955 Heat Rates Reported by FPC

	Btu/kwhr	Meters	Comb. Cont.	Feed Water Cont.	Steam Temp. Cont.
1. Kyger Creek (Ohio Valley Electric Corp.)	9,110	B		B	B
2. Clifty Creek (Indiana-Kentucky Electric Corp.)	9,143	B	B	B	B
3. Kanawha River (Appalachian Electric Power)	9,151	B	B	B	B
4. St. Clair (Detroit Edison Co.)	9,220	B	B	B	B
5. Muskingum River (Ohio Power Co.)	9,234	B	B	B	B
6. Tanners Creek (Indiana & Michigan Electric Co.)	9,273	B	B	B	B
7. Eastlake (Cleveland Electric Illuminating Co.)	9,336	B	B	B	B
8. Philip Sporn (Ohio Power Co.)	9,341	B	B	B	B
9. Shawville (Pennsylvania Electric Co.)	9,368	B			B
10. Albany (Niagara Mohawk Power Corp.)	9,373				
11. El Segundo (Southern California Edison Co.)	9,417	B	B	B	B
12. Oak Creek (Wisconsin Electric Power Co.)	9,480	B	B	B	B
13. Kearney "B" (Public Service Electric & Gas Co.)	9,511	B		B	B
14. Dunkirk (Niagara Mohawk Power Corp.)	9,523	B	B	B	
15. Cromby (Philadelphia Electric Co.)	9,540	B		B	B

B — Bailey installation

A130-2

Instruments and controls for power and process

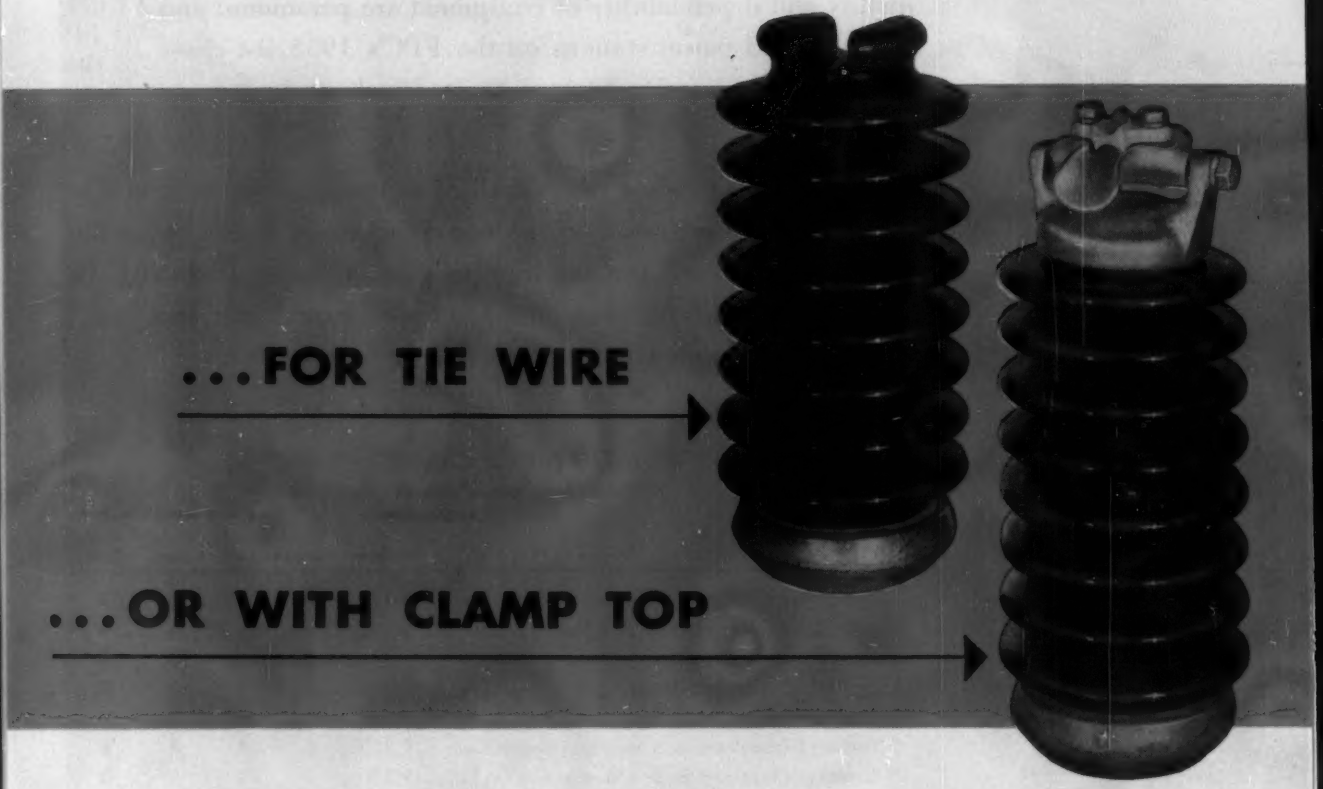
BAILEY METER COMPANY

1060 IVANHOE ROAD • CLEVELAND 10, OHIO

In Canada—Bailey Meter Company Limited, Montreal

BAILEY METERS

Lapp builds the Line Post

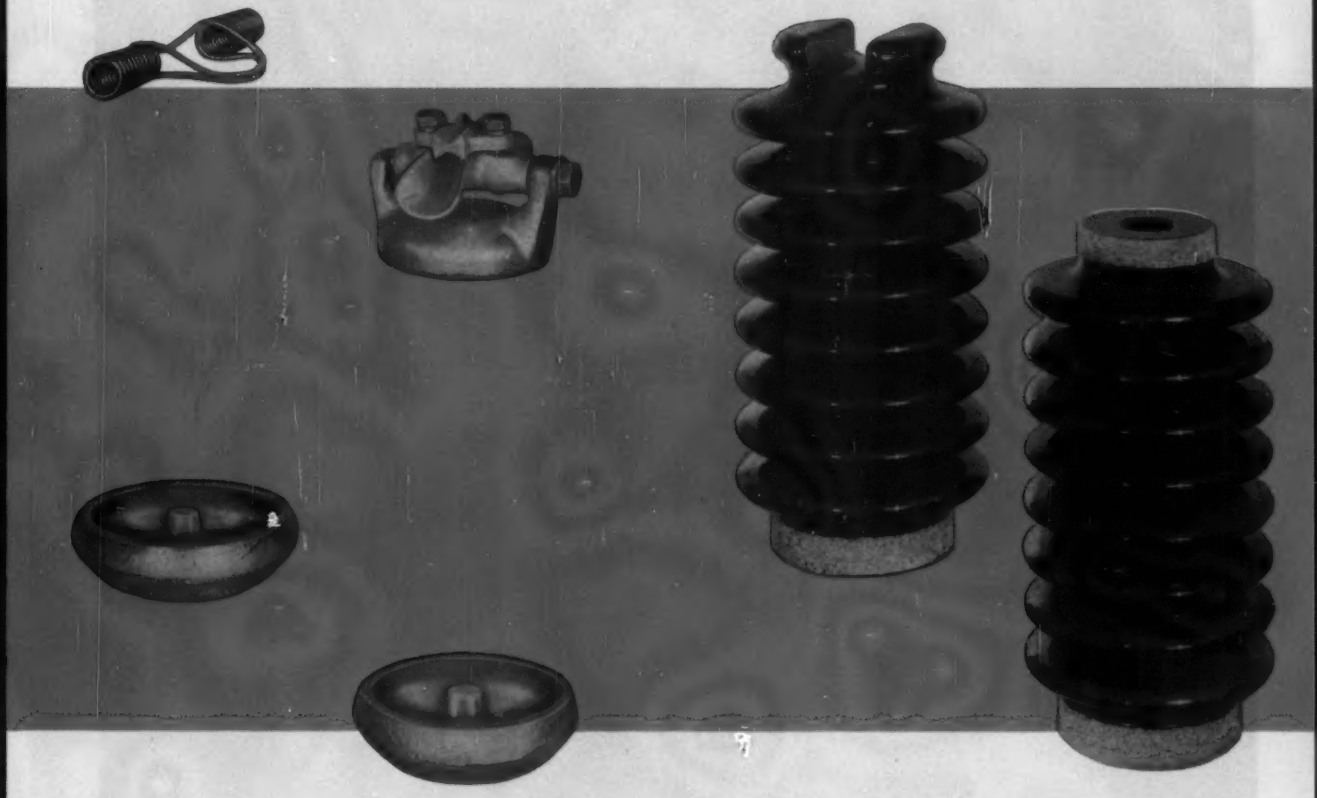


Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

This is the hardware

This is the insulator



For tie-wire installation, the Lapp Line Post provides a deep, square-side top groove. Such an installation provides a "mechanical fuse"—the conductor can slip through to relieve structure load in case conductor breaks.

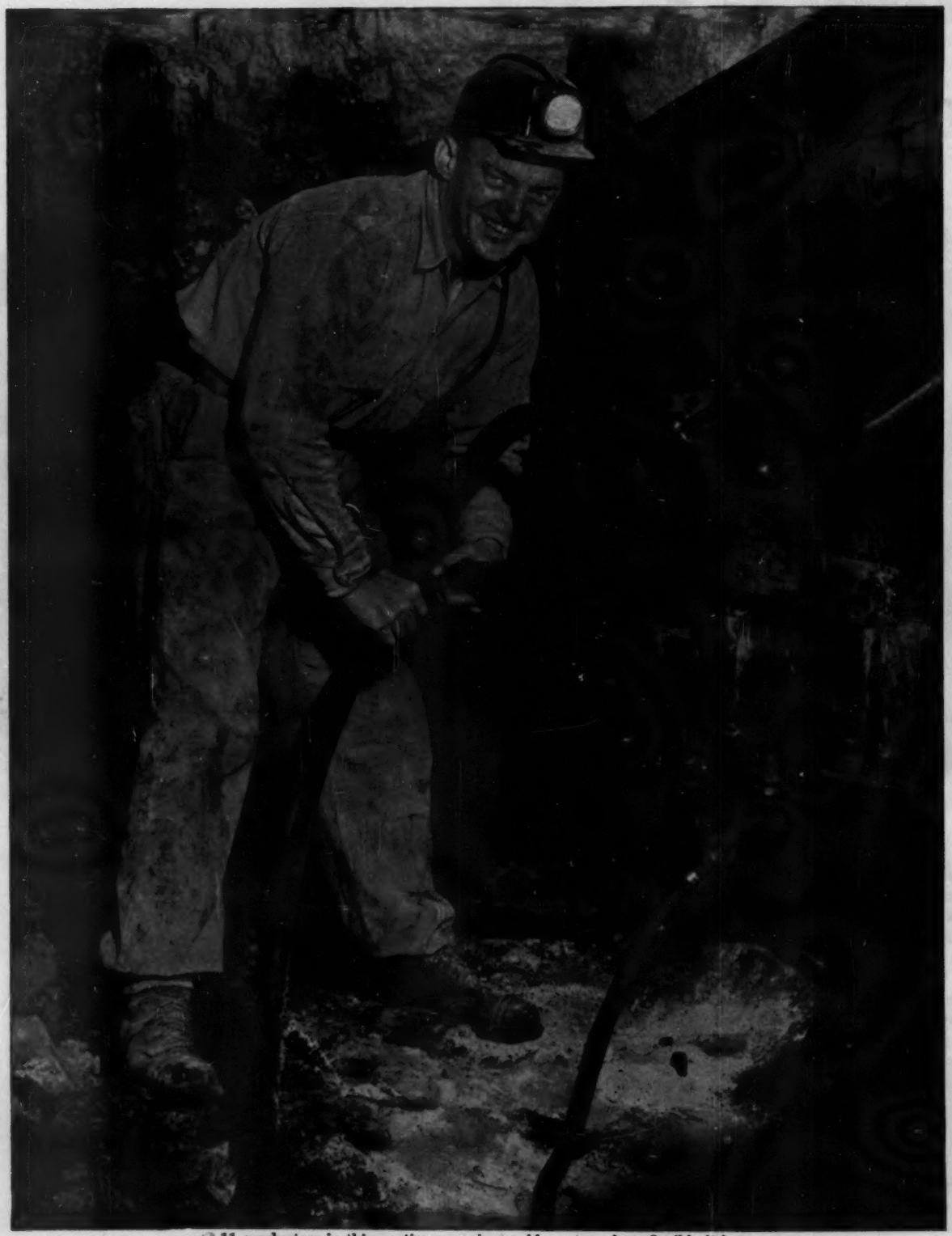
With clamp-top assembly, the Lapp Line Post provides for easiest installation or change-out of any clamp-top design. A single cap screw with captive washer is the only loose part throughout installation. For change-out, the clamp stays on the conductor. All clamps are interchangeable on all sizes of Lapp Line Posts

In either type of assembly, the tie-wire, the base or the clamp top are mechanical parts. Their function is only to attach the conductor to the insulator and the insulator to cross arm or pole—and to provide such attachment in a way that will permit the insulator to do its job faithfully.

With either tie-wire or clamp-top construction, the *insulator* is the porcelain post. It is a closed-end post of Lapp electrical porcelain of fog-type design. Its uniform long leakage path prevents leakage flashover in contaminated atmosphere. It has exceptional stamina under arcover and attack by stones and bullets because short, strong petticoats protect its sturdy body. It won't puncture because it has no conductive material within it. It won't crack, because its hardware . . . top and bottom . . . is *externally* attached, and can load the porcelain only in compression.

The Lapp Line Post will improve your service record and your maintenance record by providing an *extra* margin of operating security, low upkeep and long life.

If you watch cable costs



11 conductors in this continuous miner cable, yet see how flexible it is.

you'll like Tiger Brand

It's always a thrill to walk into a tough, cost-conscious mine and find that they are using huge quantities of Tiger Brand Amerclad mining cable. It vindicates our attitude that mining cable *must* be built to the very highest standards.

Our flat "Bridgewall" cable is an example. Tiger Brand flat twin mining cable in sizes #1 and smaller actually has a thick wall of neoprene between the insulated conductors. It locks the conductors and ground wire (if specified) in a tight embrace and holds them there—even when the cable is badly bent or twisted. No other type of construction is so durable.

Naturally, flame-resistant jackets are used throughout. And all of these very-heavy-duty cables are vulcanized in a lead mold under pressure, to insure a dense, tough jacket. *Money cannot buy a better cable!*

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL
GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

This special cable was made for continuous miner. It contains power, grounding, lighting and communication conductors.

Rubber-tired buggy fed with "Bridgewall" Tiger Brand. Cable is under *continuous strain.*

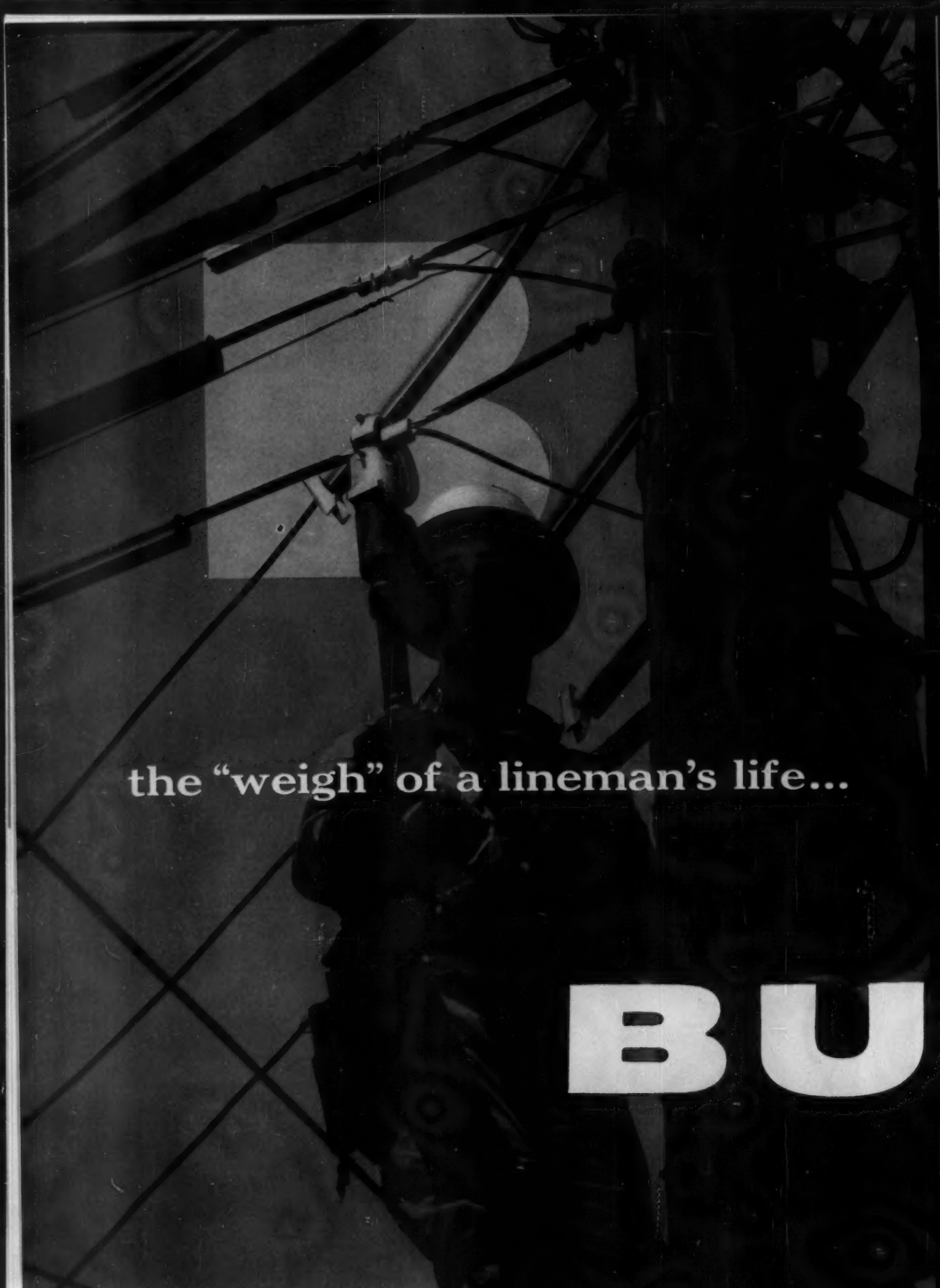
USS TIGER BRAND ELECTRICAL WIRE & CABLE

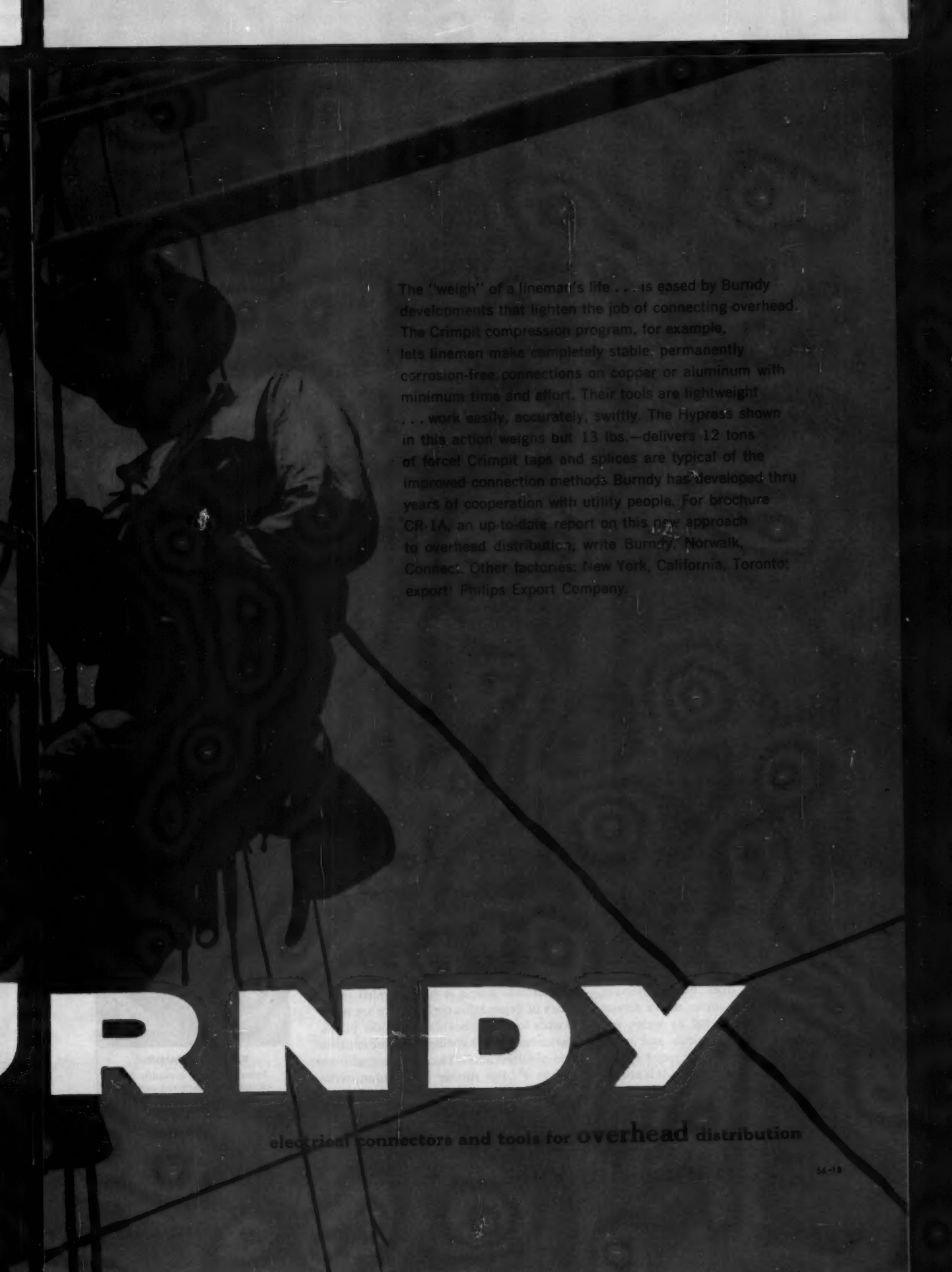
A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- asbestos wire and cable
- mold cured portable cord
- shovel & dredge cable
- paper & lead cable
- varnished cambric cable
- interlocked armor cable
- special purpose wire & cable
- aerial, underground and submarine cable

USS

UNITED STATES STEEL


the "weigh" of a lineman's life...
BU



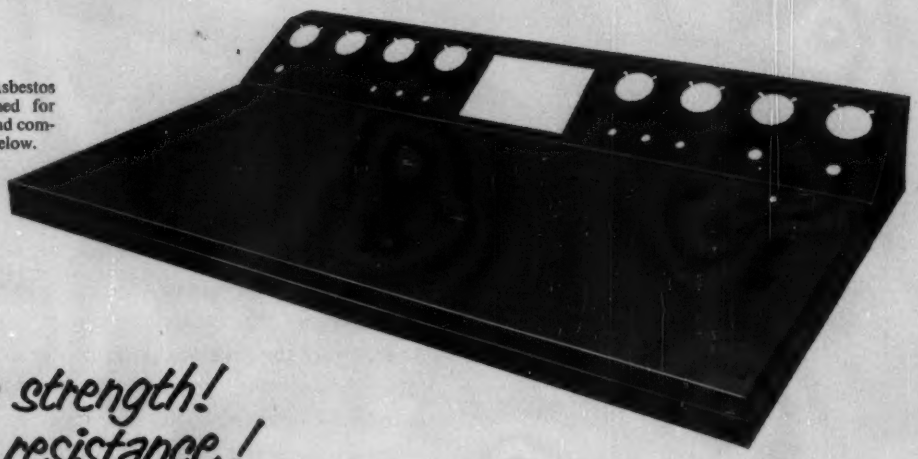
The "weigh" of a lineman's life . . . is eased by Burndy developments that lighten the job of connecting overhead. The Crimpit compression program, for example, lets linemen make completely stable, permanently corrosion-free connections on copper or aluminum with minimum time and effort. Their tools are lightweight . . . work easily, accurately, swiftly. The Hypress shown in this action weighs but 13 lbs.—delivers 12 tons of force! Crimpit taps and splices are typical of the improved connection methods Burndy has developed thru years of cooperation with utility people. For brochure CR-1A, an up-to-date report on this new approach to overhead distribution, write Burndy, Norwalk, Connect. Other factories: New York, California, Toronto; export: Philips Export Company.

URNDY

electrical connectors and tools for **overhead** distribution

56-18

Photo shows J-M Asbestos Ebony panels machined for bridge control bench and complete unit assembled below.



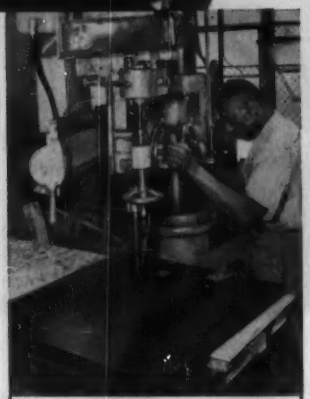
✓ *Dielectric strength!*
✓ *Insulation resistance!*
✓ *Mechanical strength!*

This console is high in all three because it's made of J-M ASBESTOS EBONY

AN OUTSTANDING COMBINATION of dielectric strength, mechanical strength and insulation resistance . . . that's what you get when you specify Johns-Manville Asbestos Ebony for electric panel boards.

Asbestos Ebony does not delaminate, shrink or crack even under severe service conditions. It is unaffected by water, oil, gas, most common chemicals and rapid temperature changes. Under moist conditions, it will not rust or corrode. It is attractive in appearance with a rich ebonylike surface.

Made from asbestos fibre and portland cement bonded under high pressure and impregnated with an asphaltic insulating compound, Asbestos Ebony is specially designed for electrical equipment. Among the applications where it has provided many years of dependable performance are panel boards for switchboards, controller plates, switch bases, bus bar supports, knife switches and circuit breakers. Thicknesses range from ⅛" to 4". For further information, write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

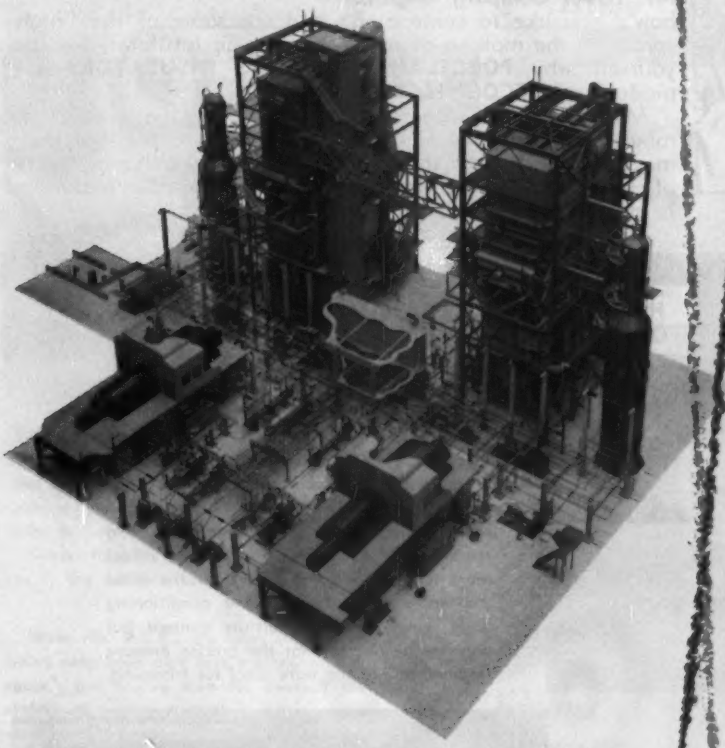


EASY TO WORK
Asbestos Ebony is readily fabricated and machined with ordinary metal working tools.

Johns-Manville ASBESTOS EBONY®

EIGHT TANKS IN ONE

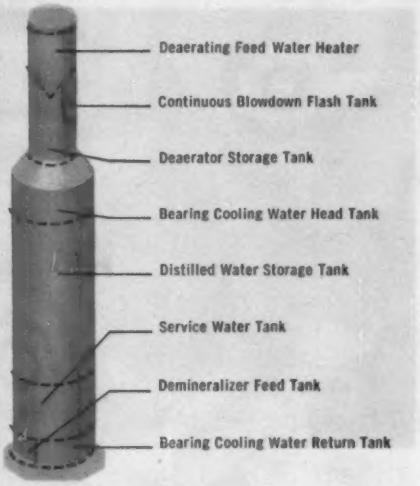
California Electric's new 120,000 KW power plant features advanced design



California Electric Power Company's new San Bernardino plant will consist of two 60,000 kw steam power units—both awarded as complete design-engineering-construction contracts to The Fluor Corporation, Ltd. Fluor recently completed for this same client a 140,000 kw steam power plant at Highgrove, California. Fluor offers the power industry a single, centralized responsibility plus the most advanced research, engineering and construction techniques. Why not get acquainted with Fluor's integrated services? Write for your copy of the Power Bulletin, *"Electric Power Plants."*

Trained to think in terms of the entire project rather than an individual service, the Fluor Corporation, Ltd.'s power plant designers developed such unique elements as the 8-in-1 tank for California Electric's new power plant.

In this outdoor plant of minimum area, the problem of locating the deaerating feed water heater and storage was solved by designing a vertical water storage unit to serve as its base. The final design was a streamlined tower consisting of eight separate and distinct chambers combined in one vertical tank.



Additional advantages of the San Bernardino plant include wide firing aisles (trucks can reach both boilers from a 16′ deck) . . . extremely compact flue and duct arrangement . . . centralized control room. The plant handles fuel oil without preheating.

When your plans for expansion call for steam, hydroelectric or nuclear power, the experience and integrated services of Fluor can serve you equally well. In single services or the entire project, Fluor is noted for the best plant value per dollar invested.

FLUOR *ENGINEERS and CONSTRUCTORS for the Petroleum, Chemical & Power Industries*

The FLUOR CORPORATION, Ltd., Los Angeles – Mid-Continent Division, Houston – Research Division, Whittier, California – Fluor of Canada, Ltd., Toronto – Singmaster & Breyer, Inc., New York City

what's goin' on?

Mr. Power Company Engineer—
how'd you like to come along and see some of the "high spots" in the making of a 10" suspension insulator, see for yourself why **PORCELAIN PRODUCTS INSULATORS** are products of **RECOGNIZED RELIABILITY.**

Mr. P.C.E., all incoming raw materials and production mixes undergo series of batch control tests to see that they meet our particular specifications. To assure homogeneity of porcelain an intimate mixture of the raw materials is essential.

HOT PRESS OPERATION

Our first "high spot", beyond the actual mixing of the raw materials in the manufacture of an insulator is the "hot press" operation. The clay (pug or blank) from the pug mill, where it has been kneaded into a solid mass and absorbed air removed by vacuum, is put in a mold and then placed in the Hydraulic Press under a heated rotating male die that forms the skirted section or underside of the insulator — the mold partially forms the top side. The mold and the hot pressed body is sent through a mold release and conditioning dryer to effect mold release. After release from the mold the ware passes through the conditioning dryer which removes moisture content but only to the degree that the precise amount retained makes the ware ideal for trimming.

TRIMMING

The ware is now placed on revolving spindles and the top surface, or surface formed by the mold, is trimmed and smoothed to its final shape. It then passes through long continuous dryers which further reduces moisture content to approximately 1%.

GLAZING

And here's our next high spot — the automatic **GLAZING** operation (accurately controls glaze thickness). This consists of coating all, or certain parts of the ware, with a glaze (glass like) which fuses to the porcelain body during its firing cycle.

This glaze has to "fit" the clay body. By "fit" we mean that the glaze has to have the property of expanding and contracting thermally with that of the underlying clay body. Any marked variation of the glaze "fit" affects the mechanical strength of the insulator.

Also, at this time, "sand bands" (specially sized porcelain grains) are applied to the areas that will form gripping surfaces for the individual parts in final assembly.

After firing the porcelain shells are given a thorough visual inspection and then placed on a continuously operating electrical testing machine, receiving a 3 to 5 second flashover test of high frequency (200 KC) voltage followed by a full five minute flashover test of 60 cycle voltage. This rigid procedure of **INSPECTION** and **TESTING** at this stage is done to assure the highest quality porcelain shell possible prior to insulator assembly.

Our next "high spot"—the **ASSEMBLY OPERATION.** Here, the cap and the stud (or pin) are cemented to the porcelain shell. Neat Portland Insulator Grade Cement (water & cement) mix is used. Note the compound on the stud, head of the shell and inside of the cap — also the Coprene washer inserted in the bottom of the pin (stud) hole.

These assemblies are now steamed (cured) for 48 hours giving about 90% of ultimate cement strength.

The insulators are now cleaned and mechanically "pull tested" to 50% of rated value.

And this is our last "high spot" Mr. P.C.E. — **the final Electrical Test.** Here each assembled unit is given a 3-5 second high frequency (200 KC) voltage and a 5 minute flashover test of 60 cycle voltage.

After this it's final visual inspection and — on to the packing tables.

Well, Mr. P.C.E., it's been a quick trip and we've only been able to hit a few of the "high spots", but you've seen for yourself the rigid system of quality control in our operations — we always welcome P.C.E. visits to our plant.

PP INC.

EEI-NEMA CLASS 52-3 PP 66255

"You've sold me! And I certainly see now why **PORCELAIN PRODUCTS INSULATORS** deserve their widespread acceptance as products of **RECOGNIZED RELIABILITY.**

Porcelain Products, Inc.

High Voltage Division — **Parkersburg, W. Va.**

Getting around the toughest taping problems . . .

CHASE

SEMI-CONDUCTING CABLE TAPES

Whether it is for complex insulating or simple binding, Chase Semi-Conducting Cable Tapes will solve your taping troubles quickly — easily — economically.

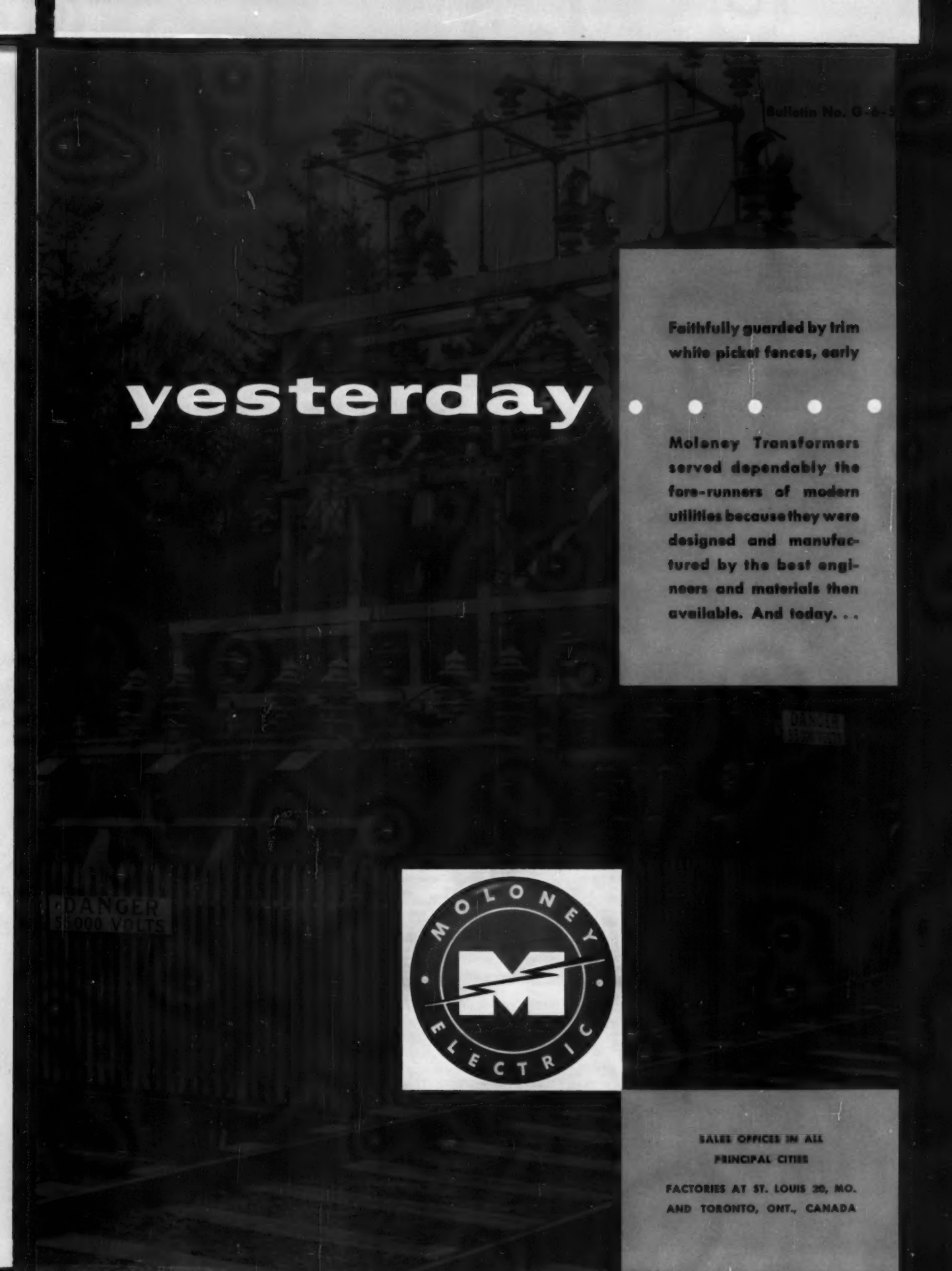
Combining high conductivity and tensile strengths with ease of handling, Chase Neoprene, Butyl Rubber and Polyethylene, Semi-Conducting Tapes, reinforced or unsupported, assure top performance even under toughest conditions.

Long life and greater "on the job" flexibility make them ideal for a wide variety of uses. Quality controlled Chase Cable Tapes may also be ordered in colors to meet special color coding and identification needs.

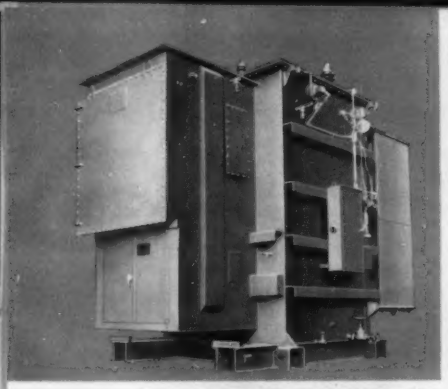
Wrap up taping troubles now! Write for complete data on Chase Tapes and Insulating Materials for the Electrical Industry. CHASE & SONS, INC., 26 Spruce Street, North Quincy, Massachusetts.

CHASE & SONS INC.
North Quincy, Massachusetts

CABLE INSULATING TAPE • CABLE BINDING TAPE
CABLE JACKET TAPE • NEOPRENE SPLICING TAPE
FRICTION, RUBBER & PLASTIC TAPE
LAMINATED & REINFORCED INSULATION


Bulletin No. G-8-5
yesterday
Faithfully guarded by trim white picket fences, early
Moloney Transformers served dependably the fore-runners of modern utilities because they were designed and manufactured by the best engineers and materials then available. And today. . .
DANGER
5000 VOLTS
MOLONEY
ELECTRIC
SALES OFFICES IN ALL PRINCIPAL CITIES
FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

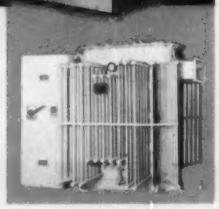
today . . .



REGULATING TRANSFORMERS AND
FEEDER VOLTAGE REGULATORS

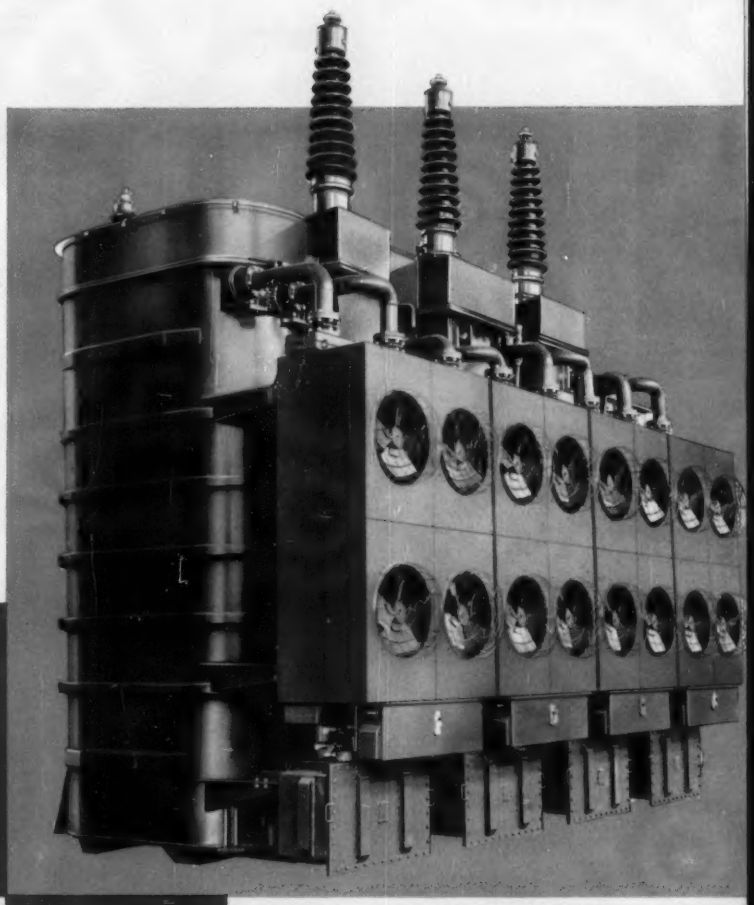
INTEGRAL PRIMARY UNIT SUBSTATIONS

ASKAREL LOAD
CENTER TRANSFORMERS



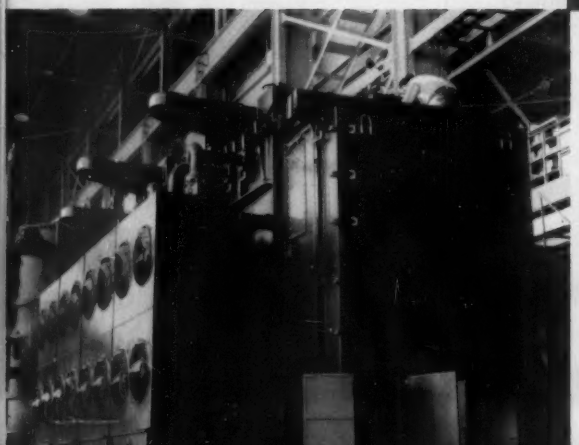
NETWORK TRANSFORMERS

SUBWAY TRANSFORMERS



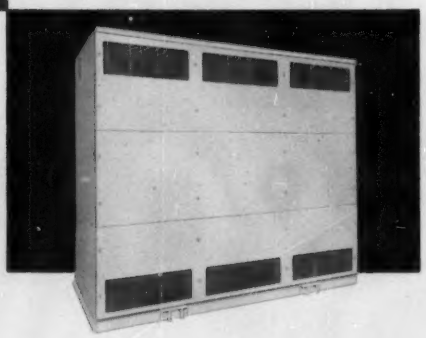
POWER TRANSFORMERS

NITROGEN-SEALED DRY-TYPE
TRANSFORMERS

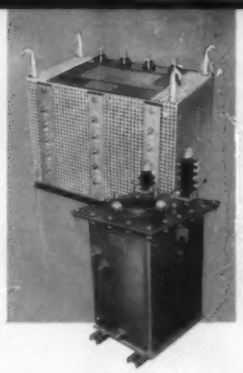


LOAD TAP CHANGING
TRANSFORMERS

VENTILATED DRY-TYPE
LOAD CENTER
TRANSFORMERS

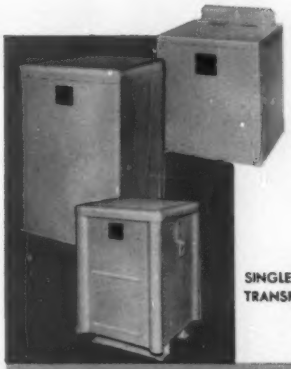


Contemporary Moloney Transformers, echoing Moloney's vast experience, serve you dependably today because they're the result of the intelligent application of creative engineering.



TRANSFORMERS AND INDUCTORS FOR ELECTRONICS

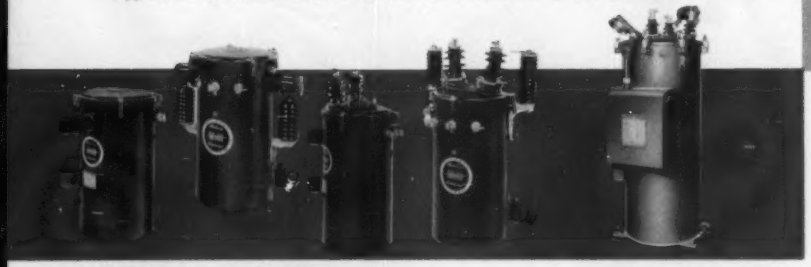
POWER TRANSFORMERS available in any Kva and voltage rating in both standard and special designs for utility and industrial application. **REGULATING TRANSFORMERS AND FEEDER VOLTAGE REGULATORS** utilize Moloney Load Tap Changing Equipment to provide constant line voltage for all transmission and feeder lines. Available in all standard and special Kva and voltage ratings. **INTEGRAL PRIMARY UNIT SUBSTATIONS** incorporate primary disconnect and secondary circuit breakers with Power Transformer and Automatic Load Tap Changing Equipment in single package for outdoor installations. **NITROGEN-SEALED DRY-TYPE TRANSFORMERS,** (Group 3 Insulation) offer ultimate in protection against fire, explosion and atmospheric contamination. Install at the job, either indoors or outdoors, without expensive vaults. Meets insurance requirements. Available in Kva and voltage ratings that meet your specifications. **NETWORK TRANSFORMERS,** designed to operate under unusual and strenuous conditions, easily handle overloads. Available in either EEI-NEMA standard or special ratings. **SUBWAY TRANSFORMERS** for installation where protection against submersion is required. Available in standard and special ratings. **ASKAREL LOAD CENTER TRANSFORMERS** permit indoor installation without fire hazard. Available in Kva and voltage ratings to meet your specifications. **LOAD TAP CHANGING TRANSFORMERS** combine Moloney Power Transformers and Automatic Load Tap Changing Equipment. Moloney versatile Load Tap Changers are available for standard and special design power transformers, also for special applications. **VENTILATED DRY-TYPE LOAD CENTER TRANSFORMERS,** (Group 2 Insulation) installed indoors, permit efficiency and economy in location. Available in all Kva and voltage ratings to meet your specifications. **TRANSFORMERS AND INDUCTORS FOR ELECTRONICS** meet size and weight limitations without compromising performance characteristics. Available in all sizes and voltage ratings. **SINGLE PHASE DRY-TYPE TRANSFORMERS**—A. TYPE DWH DRY-TYPE TRANSFORMERS. 1½ through 15 Kva, 600 volts and below. B. TYPE DWH DRY-TYPE TRANSFORMERS. 25 through 50 Kva, 600 volts and below. C. TYPE DVB DRY-TYPE TRANSFORMERS. 25 through 50 Kva, 600 volts and below. **CONSTANT CURRENT TRANSFORMERS** maintain rated lamp current on street lighting circuits under all conditions of load. Available in standard and special ratings, in both Conventional and Packaged Unit Types. **LARGE DISTRIBUTION TRANSFORMERS** for secondary substation application. Available in all standard Kva and voltage ratings. **HyperCore CONVENTIONAL AND CSP DISTRIBUTION TRANSFORMERS** available



SINGLE PHASE DRY-TYPE TRANSFORMERS

CONSTANT CURRENT TRANSFORMERS

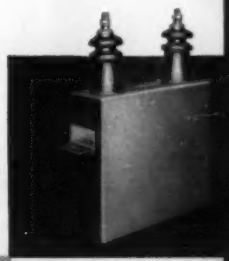
LARGE DISTRIBUTION TRANSFORMERS



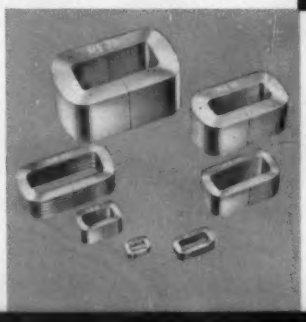
HYPERCORE CONVENTIONAL AND CSP DISTRIBUTION TRANSFORMERS

SINGLE PHASE POLE-TYPE FEEDER VOLTAGE REGULATORS

CAPACITORS

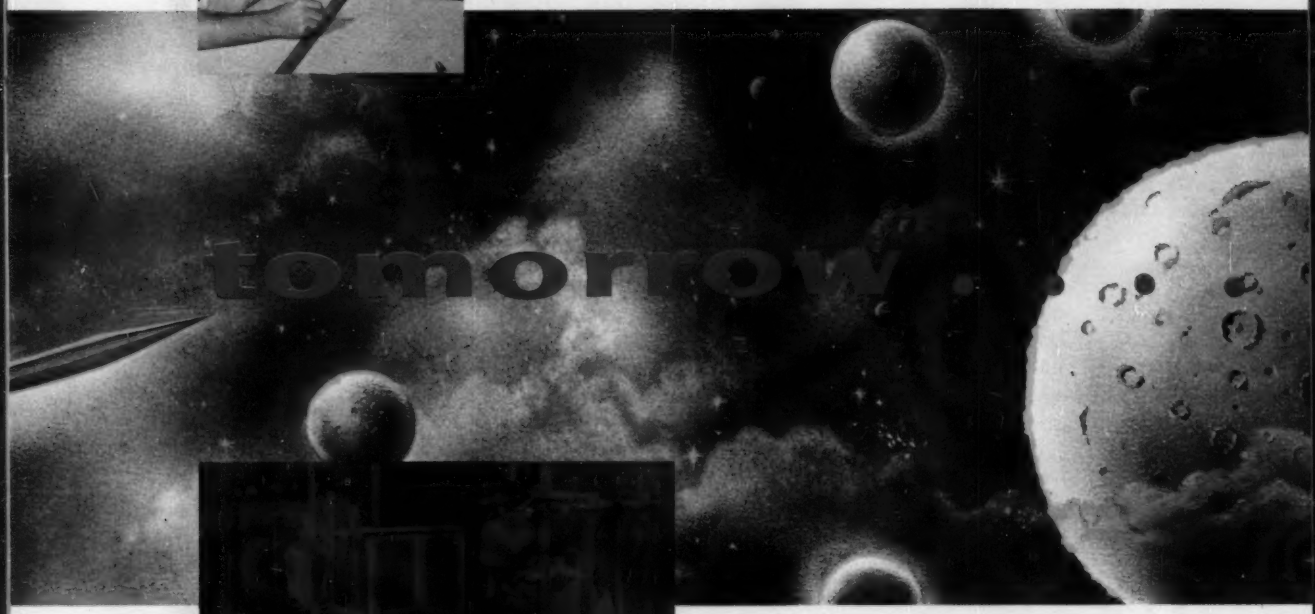


in all standard ratings. **SINGLE PHASE POLE-TYPE FEEDER VOLTAGE REGULATORS** eliminate secondary feeder regulation problems due to suburban growth and overloaded lines by providing positive, constant voltage under varying load conditions without service interruptions. Plus or minus 10% voltage regulation provided in 32-⅝% steps. Automatic control equipment can be mounted directly on the tank or at the base of the pole. **HyperCores** for electronic transformers and inductors are smaller, lighter, and have low loss characteristics. **CAPACITORS** available in standard Kvar ratings for primary voltage power factor correction.



HYPERCORES FOR ELECTRONIC TRANSFORMERS AND INDUCTORS

MOLONEY ELECTRIC COMPANY



Tomorrow's transformers depend upon today's research. Constant research and development on new materials, new design concepts, and changing needs, assure you of the continued high quality of Moloney Electric Company's Transformers for tomorrow and the day after. The time lag between "ivory tower" ideas and industrial application in high quality products is being shortened by intensive research and development in materials and concepts at the Moloney Electric Company's Research and Development Laboratory, and throughout the manufacturing facilities of the plant.

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SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

1956: A New Set of Records to Beat

The year 1956 has been one of solid growth and development in virtually all branches of the utility industry. Records show that the pace of expansion exceeded the long-term rate by a good margin.

On all fronts this year electric utilities have accelerated their efforts to serve every American with electricity cheaper and more effectively than ever.

The success of these efforts is written in this Electrical World's 53rd Annual Statistical Report. Here is to be found the numerical measure of what the utility industry has accomplished in 1956 and the key to its future growth and development.

• In generation by year-end the industry's $3.8-billion expansion program boosted installed generating capacity to 120.3 million kilowatts, an increase of 5.8 million over 1955. A spectacular 40 million kilowatts more is on order for installation between now and 1960.

• Energy generated by the utility industry was 601 billion kilowatt hours in 1956,—54 billion more than the year before and twice that produced in 1949. Of this 601 billion kilowatt hours produced, 529 billion were sold to ultimate customers who numbered 54 million. This is 10% more sales and 1.4 million more customers than last year.

• Revenue from these sales reached a record $8.7 billion in 1956. All classes of revenue contributed to the 8.7% increase. The largest were in industrial and residential classes with both up 9%. Small light and power was close behind with an 8% increase.

• Use-wise America's determination to Live Better . . . Electrically was never more apparent than in 1956. The average home use scored the biggest increase ever, climbing 229 kilowatt hours over the 1955 average to 2,980 kilowatt hours. And there were 1.3 million more residential customers at the end of 1956 than the year before.

• This year the average domestic kilowatt hour sold for 2.59 cents, well below the 1955 average of 2.64 cents. The average annual bill of residential customers in 1956 was $77.18 compared with $72.63 in 1955.

• Fuel conversion efficiency of the industry's steam stations continued its steady improvement. This year it took only 0.94 of a pound of coal to make a kilowatt hour; 28% less than in 1946. Looking ahead some new plants now being designed to use units of 330 and 450-Mw capacity and steam in the super-critical pressure range will produce a kilowatt hour for only three-fifths of a pound of coal.

• Utility operating ratios in 1956 held within 1/10 of 1 percentage point of the record low level of 44.3% reached in 1955. On a revenue dollar basis fuel jumped up ½ of 1 percentage point; maintenance and other operating expenses held steady, and salaries and wages were down 4/10 of 1 percentage point compared with 1955.

• Looking ahead to 1957, a sharp increase in capital spending for generation and transmission will absorb 88% of a more than $1 billion increase in budgeted expenditures. Total industry spending will top $4.8 billion. Generation expenditures will be up $747 million, transmission expenditures up $181 million, and distribution up $100 million from 1955.

Added up, these are the things that have marked 1956 as a year of solid growth and development and 1957 as a year in which the electric utility industry will continue the rapid expansion that has long been its hallmark.

AIEE Pres Coover presents Edison Medal to Dr Adams as Kappel watches

AIEE Scores Engineering Training

Pres Coover deplores a rising barrier between high school and college. Adams, receiving Edison Medal, says U. S. needs national free educational program to tap brains now being wasted

Engineering education must be geared to today's "astounding acceleration" in technology, M. S. Coover, president, told the winter general meeting of the American Institute of Electrical Engineers Jan. 21 in New York.

At the meeting's general session, the 1956 Edison Medal was bestowed on the educator and engineer, Dr Comfort A. Adams of Philadelphia. The 86-year-old Harvard University professor emeritus is the 46th recipient of this high profession award.

"The lengthening dimension between high school terminus and college entrance requirements is acute, it is tragic, and it seems incredible that we can think of continuing to have a well integrated educational system in America without taking immediate steps to reduce that dimension," Coover declared.

"One major obstacle," he continued, "is the lure of industrial salaries with their accompanying benefits which is rapidly depleting colleges and universities of quality teachers."

In accepting the Edison Medal, Dr Adams urged a national educational program for the "utilization of 100% of our native ability." He proposed free education and "modest allowances for living expenses" for promising and needy students.

At present, about 1/9 of our total youth gets a first college degree and this group includes practically all those who continue into either professional or public life, Dr Adams declared.

Brainpower Being Lost

"I'm convinced," Dr Adams continued, "that the average brain power of the 8/9 group is more than half that of the 1/9 group and that the number of brilliant minds in the larger group is more than that in the smaller group. Our dependence on the smaller group constitutes a serious and unnecessary limitation."

In defending his proposals for raising the general level of intelligence, Dr Adams noted that many people would object to the "addition of the socialistic feature to our public schools."

"But fortunately," he said, "we're not without some experience in such matters. The GI Bill of Rights provided the same kinds of opportunities I propose, and many profited by it."

Other examples, he said, are the present free education through high school, state universities, the Post Office, public roads and bridges, public water works and sewage systems, all government departments headed by secretaries in the President's cabinet, Social Security and welfare acts, and the thousands of

successful cooperatives."

B. G. A. Skrotzki, editor of Power and chairman of the AIEE committee on prize awards, announced the following award winners and their papers:

L. O. Barthold, I. B. Johnson, and A. J. Schultz, General Electric Co, Schenectady, N. Y., "Switching Surges and Arrestor Performance on High-Voltage Station." J. S. Tompkins, Aluminum Co of America, Pittsburgh, Pa., L. I. Merrill, Stevens Institute of Technology, Hoboken, N. J., and B. L. Jones, Kansas City, Mo., "Quantative Relationships in Conductor Vibration Damping."

L. S. Schwartz, Hazeltine Electronic Corp, Little Neck, N. Y., "Principals of Noise Reduction in Communication Channels." L. A. Weber, Bell Telephone Labs, New York, "Influence of Noise on Telephone Signaling Circuit Performance."

W. T. Dubic, Westinghouse Electric Corp, Boston, C. L. Moore, Westinghouse, Sharon, Pa., and P. A. Zaphyr, Westinghouse, East Pittsburgh, Pa., "Application of a Digital Computer to the Design of Power Transformers to Specifications." A. S. Hoagland, University of California, Berkley, Calif., "Magnetic Data Recording Theory."

William B. Bridges, Palo Alto, Calif., University of California, "A Pulse Generator Using Non-Linear Magnetic Cores." Geoffrey D. Green and Lawrence M. Hill, both of the University of Colorado, "An Electromechanical Tic Tac Toe Machine."

New Officers Nominated

Nominations for 1957-58 AIEE offices were announced. These included, for president, William J. Barrett, New Jersey Bell Telephone Co; for vice presidents, Benjamin R. Teare, Jr, Carnegie Institute of Technology; Robert W. Oetinger, Duke Power Co; Albert G. Johnson, Omaha Public Power District; Orien A. Gustafson, General Electric Co, and Gordon F. Tracy, University of Toronto.

Directors named were: Edwin W. Morris, Westinghouse Electric Co; William R. Clark, Leeds & Northrup Co; J. C. Strasbourger, Cleveland Electric Illuminating Co, and L. F. Hickernell, Anaconda Wire & Cable Co.

U.S. Needs "3-D Engineers"

Kappel tells AIEE how AT&T gets "more work done so soon and so well." The secret, he says, lies in developing a man's second and third dimensions

Business and society today needs "three-dimensional" engineers, Frederick R. Kappel, president of the American Telephone & Telegraph Co, told the winter general meeting of the American Institute of Electrical Engineers Jan. 21 in New York. He was the general session's main speaker.

Routine Approach Is Passe

"In this dynamic and expanding world," he said, "there is simply no room for routine approaches to engineering, or for standing still with the mental equipment we've got."

The engineer, Kappel said, acquires his first dimension in college, and the second in industry through continued training and self study. The third dimension, he continued, is the "height" acquired from mingling engineering and management ideas so that the engineer's understanding of the problems and requirements of his business makes him more effective in that business.

"We shall have a continually rising proportion of older people who have finished their working years and for the next decade a larger proportion of young people below working age," Kappel noted. "This means that a relatively smaller working group will have to support a much bigger nation.

"If we expect to do this in the style to which Americans have become accustomed and, I hope, push the standard of living higher, we have a real job on our hands. Technological progress is not something that we can just look forward to with pleasant anticipation. It's a necessity.

"In the Bell System alone we expect to invest $2½ billion this year in . . . equipment," he said. I saw one forecast the other day—probably conservative—that industry would lay out $40 billion for new plant and equipment in 1957, and that the annual outlay would pass $55 billion by 1965.

"Who will say that all this money is wisely spent? To a very considerable extent, the engineer, the architect of industry, who must make sure that this huge investment will produce at a profit. And as he works at his job, the technical resources he is working with and the needs of the people are constantly changing."

The need of engineers, Kappel declared, "cannot be filled by just tagging or labeling people as engineers. We won't do it by putting engineers into compartments and shutting them off from the rest of the ship. We won't do it by cramming size 42 men into size 36 jobs, or vice versa. We won't do it by setting so-called minimum standards and then sitting back and letting nature take its course.

"Industry can contribute much, especially to the engineer's second and third dimension," Kappel said. "Because of the effort we're making in the Bell System, we're getting a wonderful amount of fine engineering work done that otherwise could never have been done so soon or so well.

Engineers Profit Three Ways

"More than that, with a wider appreciation by other people in management of the engineer's contribution, his ability, his point of view, I'm confident we're getting a better team and a better over-all job. I'm equally confident that our engineers are profiting in prestige, promotion, and salary rewards.

"As the need for technology increases, it seems to me inevitable that the need for engineers in management, including top management, will continue to increase.

"As I see it," the speaker continued, "the challenge to engineers today is that they should deliberately work to fill out all the height, all the depth, and all the breadth they can reach. Along with this, industry is equally challenged to give able engineers full opportunity to live, work, think and create in all three dimensions."

W. J. Barrett to Be Next AIEE President

Election to be announced June 24, but Barrett is unopposed. Five vice presidents and three directors also are to be chosen by AIEE's 50,000 members

AIEE Leader: W. J. Barrett

Walter J. Barrett, Glen Ridge, N. J., transmission maintenance engineer of the New Jersey Bell Telephone Co, will be 1957-58 president of the American Institute of Electrical Engineers. Barrett's nomination was announced Jan. 21 at the opening session of the institute's winter general meeting in New York. He is unopposed.

Barrett's name, along with those of five vice presidents and three directors, will be submitted to the AIEE's 50,000 world membership. Results of the mail ballot will be announced June 24 at the institute's summer general meeting at Montreal, Canada. Their term will start Aug. 1.

Barrett, president of United Engineering Trustees since 1955, has been AIEE treasurer since 1953. He has served the institute as director and as retirement system trustee. A member since 1930, he was elected fellow in 1950. Barrett has headed special committees to study the institute's building needs and headquarters methods and equipment. He has been a member of the coordinating, board of examiners, communications division, sections, Lamme Medal, headquarters, and nominating committees. Since 1950, Barrett has served on the executive committee of the board of directors. He has chairmanned the AIEE's finance committee and the New Jersey division of the New York section. He was 1947 section chairman.

Barrett received his EE degree cum laude from Polytechnic Institute of Brooklyn in 1920. He has worked with American Telephone & Telegraph Co, Ohio Bell Telephone Co, and since 1930 with his present company, mostly in the coordination of power and communications systems.

Goodrich Wins Load Forecasting Contest

Five industry men tie for second-place in annual kwhr power generation derby, the tightest race experienced in 11 years. 1957 entries invited

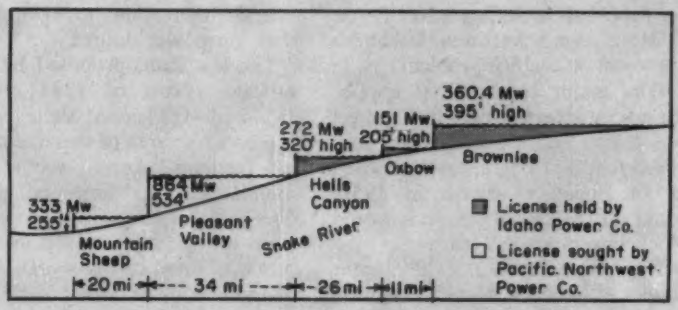
Winner: R. H. Goodrich

New champion of the load forecasters is R. H. Goodrich, superintendent of power production, Indianapolis Power & Light Co. He gains the title by winning the 1956 Kwhr Power Generation Pool—coming within .01% of the Federal Power Commission's figure of 601,440,726,000 kwhr. Goodrich's guess, entered last February, was 601,501,000,000 kwhr. He won over 437 contestants, who also submitted guesses.

Goodrich, along with eight other front-runners in the annual event, will receive a diploma conferring upon him the title of "Master in the Art of Load Forecasting" from Robert M. Hatfield, contest director and vice president of Combustion Engineering, Inc. Hatfield reminds forecasters to send their 1957 estimates to him at 200 Madison Ave, New York, 16, N. Y., before Feb. 28.

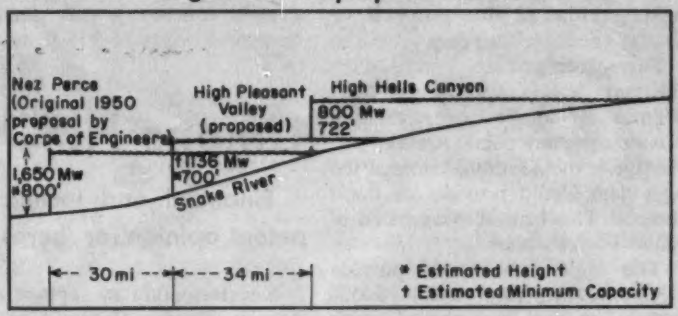
Never before in the 11-year history of the pool have the guesses been as close as in the 1956 contest. Five men tied for second-place with identical guesses of 601,522,000,000—a flat 10% over the previous year's figure. Second-placers are W. A. Dittmer, Kaiser Aluminum & Chemical Co; Paul E. Gourdon, Ebasco Services, Inc; John H. Jamison, Central Illinois Electric & Gas Co; H. T. Tilly, Indianapolis Power & Light Co; and Frank M. Warren, president, Portland General Electric Co. Tilly was a second-placer in 1954.

Very close to this group was J. M. Gerber, Cleveland Electric Illuminating Co, with a guess of 601,358,000,000 kwhr to win third place. In fourth place was E. H. Snyder, vice president, Public Service Electric & Gas Co. Winding up the list in fifth place, still only .02% away from the accepted figure, is Ernest R. Acker, president, Central Hudson Gas & Electric Corp. Snyder, winner of the 1950 pool, has taken part in the contest for 11 years.



Plans by private groups to harness the Snake River . . .

Vie with recent government proposals in . . .



The Tangle of Pleasant Valley

- **Reclamation's recent proposal for a federal high dam at Pleasant Valley will paradoxically be opposed by public power proponents who favor a high Hells Canyon, Nez Perce**

- **Yet Seaton's probable approval of the new plan would tread on toes of Idaho Power and Pacific Northwest Power**

Public power supporters may soon be in the peculiar position of opposing a proposal for a federal hydroelectric project.

This paradoxical situation comes about from the anticipated recommendation of Interior Secretary Fred A. Seaton for federal construction of a high dam at the Pleasant Valley site on the Snake River.

This possibility has been strengthened by Seaton's announcement that he will ask Federal Power Commission to hold up action on a license application from Pacific Northwest Power Co for a project at Pleasant Valley.

PNP is seeking a license for two dams: Mountain Sheep and Pleasant Valley. FPC hearings were recently completed on the application. A hearing examiner recommendation is due sometime in March. But for the past months Seaton has been studying a Bureau of Reclamation report proposing a higher dam at Pleasant Valley.

Now Seaton, in intervening before FPC, says that the study indicates a higher dam at Pleasant Valley would be possible. This, however, has to be confirmed with more detailed engineering studies.

But if the Administration had hoped to still the public power clamor over Hells Canyon, and placate any ruffled political feelings in the Northwest, they are mistaken. Public power forces will fight the proposal for two reasons: They want a high federal Hells Canyon dam and a federal Nez Perce dam. High Pleasant Valley would kill both.

Seaton also would be treading on other toes in proposing the high Pleasant Valley dam, for it would flood out the licensed lower Hells Canyon dam, one of three which Idaho Power Co is building.

The High Pleasant Valley story started last September when Seaton asked the Bureau of Reclamation to make a study of the Pleasant Valley site. About the same time, Sen James E. Murray (D-Mont.), Interior Committee chairman, asked Sen Robert S. Kerr (D-Okla.) of the Public Works Committee to explore several alternative plans with the Corps of Engineers. Three of these proposals included some form of Nez Perce dam. The third is the same arrangement as that proposed for a High Pleasant Valley dam: Low Mountain Sheep, High Pleasant Valley, Oxbow, and Brownlee.

Chief of engineers, Maj Gen Emerson C. Itschner, gave Kerr detailed answers only on flood control

storage. These were most favorable for proposals including a Nez Perce.

More significant was Itschner's comment on the fish problem.

The major reason PNP applied for a license for the two-dam project was that it had generally been conceded that Nez Perce, first proposed in an Engineers report in 1950, could not be built because it would block important fish runs.

Now Itschner claims that recent studies "indicate some promise" for passing migratory fish at high dams. He has thus provided public power groups with the basis for fighting either PNP's proposal or Seaton's possible high dam proposal.

Disregarding Nez Perce, high Pleasant Valley appears to have definite advantages over existing private company plans. A major advantage is the additional storage the high dam would provide for flood control. This benefit is sacrificed in Idaho Power's plan.

The high dam would provide 1,300,000 acre-ft of usable flood-control storage, compared with 520,000 acre-ft that would be provided by the two low dams.

Output Factor Is Major Issue

The power elements of the controversy are those that generate the most political heat.

Bureau of Reclamation estimates that the high dam alone would produce 4.1-billion kwhr per year at the site. The plan calls for generating power during nine months from August to April, with the other three months being used to catch flood waters. Water released during the generating months would also increase the firm power output of downstream plants — Mountain Sheep and eight others in operation, under construction, or being considered—by 890 million kwhr per year. Thus the high dam would produce an annual power increment of more than 5 billion kwhr.

This compares with an annual firm power estimate by PNP for its two dams of 4.85 billion kwhr.

As of now there is no figure on total power output from federal sources for high Pleasant Valley plus Mountain Sheep. But Reclamation has estimated that the annual total, including the increment at downstream plants, would be about 6.54-billion kwhr. Obviously, the federal high dam tops opposing plans on power output.

The low dams proposed by PNP indicate a cost of $234 million. PNP's 534-ft Pleasant Valley would be a concrete arch of variable radius and thickness costing about $100 million. The six proposed generators are larger than any in the world yet operating—49 ft in diameter, with rated capacity of 144,000 kw and maximum output of 170,000 kw each. Turbines would develop 233,600 hp each.

Mountain Sheep would be straight concrete gravity dam with structural height of 255 ft and estimated cost at $56 million.

All this engineering data—and more that's obviously needed—will be hashed over in the months ahead, whether or not the Administration decides to favor the high dam. If Seaton lets the private companies go ahead, the Democrats will jump in just as hard as they did on Hells Canyon—this time they think they would stand a better chance.

If Seaton backs the high dam, he'll have to decide whether to go for an all-federal project or whether to take the partnership approach allowing the utilities to finance the power generating equipment and have title to the power therefrom.

Unions Hit PRDC Testimony

Financial and technical evidence described as 'incompetent opinion' or 'heresay' by lawyers of three unions

Key testimony in support of an Atomic Energy Commission construction permit for Power Reactor Development Co's nuclear project near Detroit has been labeled "incompetent opinion," "hearsay," or "immaterial" by three labor unions.

The United Auto Workers, Paperworkers, and International Electrical Workers, have filed objections to testimony offered by PRDC witnesses Jan. 8 when hearings opened into the safety of the proposed project. The unions had requested the hearings to oppose AEC's granting a conditional construction permit to PRDC, and also to question the financial ability of PRDC.

Their objective is to force AEC to suspend the construction permit, or to declare, on the basis of facts presented by PRDC, that the project can be operated without undue risk.

PRDC had asked Ernest R. Acker, president of Central Hudson G&E and PRDC vice president, to testify on the company's financial qualifications.

His testimony that firm commitments had been given by the 23 member utilities of PRDC for a total of $23.5 million in contributions was termed hearsay by union lawyers on the grounds that he was stating a legal conclusion for which he had not been qualified. Acker's statement about a loan agreement with a group of banks for $15 million similarly was called hearsay.

Union lawyers brushed aside the technical testimony of Dr Hans A. Bethe, one of the country's leading nuclear physicists. Bethe, an adviser on the PRDC project, spoke at length on factors he believed would make the PRDC reactor safe.

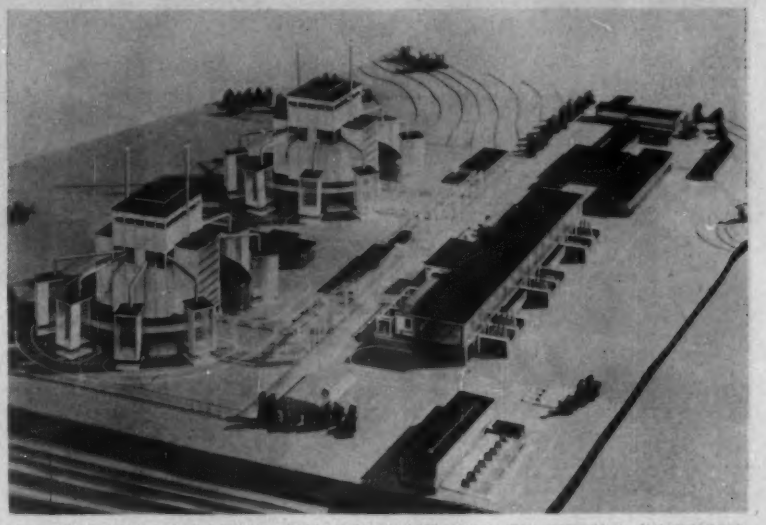
Rules Out Reactivity Danger

Bethe said, in effect, he could see no way in which reactivity could exceed the critical point in a reactor of the type proposed. And even if it did, he added, the worst accident that could follow would be comparable to a boiler explosion in a conventional power plant.

This, say union lawyers, "is incompetent opinion testimony. It is a patently self-contradictory statement, based on theoretical considerations for which no experimental data are shown to exist."

Bethe also said experimental work now under way would establish that a rapid rise in temperature with increased reactivity (positive temperature coefficient) and a consequent meltdown of the reactor fuel assembly were factors which could be controlled and would not make the reactor hazardous in populated areas.

Britain to Add 3 Calder Hall Type Plants to A-Pool



THIS "IMPROVED" A-PLANT WILL NOT MAKE ANY COMMERCIAL PLUTONIUM

Pictured at right is a conception of the 275,000-kw Calder Hall type nuclear power station to be built at Berkeley, Gloucestershire, for Britain's Central Electricity Authority. It is one of two planned by CEA at a capital investment of not less than $395 per kw.

To be constructed by Associated Electrical Industries-John Thompson Nuclear Energy Co, the plant will generate power with two natural uranium, carbon-dioxide-cooled, graphite-moderated reactors supplying heat to 16 boiler units, eight to a reactor. Superheated steam will drive four dual-pressure turbo-generators of at least 80,000 kw capacity each.

The second CEA plant will be built at Bradwell, Essex, by Nuclear Power Plant Co. Modeled after Calder Hall, now in operation, this plant will have a 300,000 kw capacity. Reactor details are the same as for Berkeley, except that the two reactors will supply heat to 12 boiler units, six to a reactor. Steam will drive six 52,000-kw generators.

A third Calder Hall type plant is slated for Hunterston, Ayrshire, Scotland. General Electric Co and Simon-Carves Group will build the 320,000-kw plant for South of Scotland Electricity Board. Total charge of uranium fuel will weigh 500 tons. Fuel elements will be magnesium alloy clad, as in the cases of Bradwell and Berkeley.

PRDC Execs Fly to Europe to Study Atom Policies

A group of utility executives associated with Power Reactor Development Co in building the Fermi atomic power plant near Detroit have flown to Europe to exchange information relating to industry policies. They will visit top officials in Britain's Atomic Energy Authority, Central Electricity Authority, and Calder Hall plant. In France, they will confer with top men of the French atomic energy commission, and Electricite de France.

Pictured above left before takeoff are: Walter C. Beckjord, president, Cincinnati G&E; James H. Campbell, senior vice president, Consumers Power Co; Errol W. Doebler, president, Long Island Lighting Co; and Louis R. Gaty, vice president, Philadelphia Electric Co.

Above right: Ernest S. Fields, vice president, Cincinnati G&E; Robert E. Ginna, president, Rochester G&E; Arthur S. Griswold, assistant to the president, Detroit Edison Co; Herbert J. Scholz, president, Southern Services; and Charles H. Whitmore, president, Iowa-Illinois G&E.

Connecticut's Turnpike Is a Pace-Setter

A 53-mile stretch will be lighted continuously to meet recommended safe practice. Mercury vapor units will be staggered 100 feet apart

Connecticut's Department of Highways is engineering night safety into its new superhighway scheduled for completion this year. The Connecticut Turnpike thus may be considered a pace-setter for states which will be scrambling to spend $24.8 billion in federal funds on new and better highways in the next ten years.

Connecticut Highways Commissioner Newman E. Argraves has disclosed the state's intentions to light 53 continuous miles of the Connecticut Turnpike linking Greenwich and Branford.

Mercury vapor luminaires staggered 100 feet apart and hanging 30 feet over the four-lane divided turnpike will light all but seven miles of the strip. The seven-mile stretch will be used experimentally to test fluorescent lighting. This strip runs between Stamford and Darien.

The 53-mile stretch will be the longest in history lighted in accordance with recommended safe practice. The decision for providing adequate illumination grew out of a before-and-after study conducted earlier on a 7.25-mile strip of the Berlin Turnpike. During a 12-month period after new lights were installed, nighttime accident rates dropped 11% from 560 accidents per hundred-million vehicle-miles to 495. The injury rate dropped 29% from 610 to 433. The fatality rate dropped 100% from 8.65 to zero. In addition to this statistical impetus, a public opinion survey showed that the public was "overwhelmingly" in favor of good highway lighting.

Argraves said continuous lighting on the heavily traveled western leg of the 129-mile turnpike is aimed at realizing three objectives:

- To reduce nighttime accidents by improving driver vision.
- To contribute to driver comfort, thus encouraging night driving to lessen evening peak loads.
- To increase roadway capacity at night by making outer lanes less forbidding, thus encouraging drivers to use the full road width.

Argraves also stated that the Commission is giving serious thought to the installation of amber lighting units at turnpike exits to provide advance warning to the motorist. This will give him more time to cross lanes to make the exit he seeks.

Until now, highway lighting has been almost exclusively confined to hazardous locations. Never before has any state highway been lighted properly for such a distance.

Connecticut's lighting plans have been hailed as "an historic milestone" toward curbing accidents at night.

Changes in Florida

Tampa Electric Co, which traditionally has generated power with gas as a fuel, is building a big plant to take coal—barged across the Gulf of Mexico from the Nashville (Ky.) Coal Co. Nashville Coal has been buying a fleet of Diesel towboats and steel barges to haul coal from Western Kentucky to New Orleans for transfer to ocean-going barges. These will haul the fuel across the gulf to Tampa.

Until now, high railroad freight rates have made it more economical for Florida utilities to burn gas.

Meanwhile, a Suez-induced oil shortage has hit Jacksonville Dept. of Electric & Water Utilities in its pocketbook. The municipal has been notified of a 35¢ per barrel fuel oil increase. Utilities Commissioner J. Dillon Kennedy is recommending a "strongly worded" telegram to Eisenhower calling for investigation of spiraling oil prices and possible federal regulation. The new hike, he said, is creating serious budgetary problems for his and other municipals. However, he foresees no immediate rate increase above the 3% raise granted Jan. 8 (effective Feb. 28) based on previous oil prices. Orlando Utilities Commission, however, may compensate for higher fuel oil through an escalator clause in customer contracts. Under the clause, residential rates are boosted one-eighth of a cent per kilowatt for each 50¢ increase in a barrel of oil.

England Has Troubles, Too

American utilities are not alone in getting customer complaints. England's South Eastern Electricity Board reports receiving the following letter which "excited sympathy:"

"I have had this property inspected, tested, checked, connected, and threatened with disconnexion by so many inspectors, testers, connectors, and checkers, that it would please me to know how many actually inspected, tested, or connected, including those who arrived to inspect, test, or connect after the inspection, testing, or connecting had already been done."

New Jersey Is Foiled

The State of New Jersey has failed to win $18,416 from Atlantic City Electric Co in an escheat action started in 1949. Atlantic City Electric collected deposits from 1902 to 1934 from customers—mostly summer residents—to cover bills if the customers left without paying. Many deposits were never called for. They have been collecting interest at 4%. The State contended that unclaimed money belongs to New Jersey. Atlantic City said the State should have filed for the deposits within six years after they were collected—citing the statute of limitations. The N. J. Supreme Court agreed with the company.

Ahead: Capacity Tripling

The Federal Power Commission in a forecast said the nation's electric utility capacity must be tripled by 1980 to meet the load. The forecast said that by 1980 utility loads will reach 335 million kw, and a generation of 1,821 billion kwhr. This is a 7% increase over the prediction made in 1955. In contrast, said the FPC, utilities in 1955 had a 114-million-kw capacity and produced 553 billion kwhr.

Police Catch "Mad Bomber"

New York City detectives have caught the "Mad Bomber"—an avowed hater of Consolidated Edison—who has terrorized the city for 16 years (EW, Dec. 10, 1956, p 98).

Police said George Metesky, 54, Waterbury, Conn., had confessed planting 31 bombs, of which 21 went off, hurting 15 persons.

Metesky's vengeance on Con Ed springs, he said, from an injury received in 1931 while working for Con Ed's predecessor United Electric L&P as a generator wiper. Metesky told police that he was hit by a back draft of hot gases while passing a boiler. Fumes knocked him down and brought on internal hemorrages. Pneumonia developed, followed by tuberculosis, he said. He was retired because of health, but received 80% of his wages for 26 more weeks as sick pay, a Con Ed spokesman said. "Metesky only worked for us three years," the spokesman added.

Metesky later filed workmen's compensation claims, but all were voided by the statute of limitations.

$2,000 Will Fix It

Junius D. Grimes has filed suit against Virginia Electric & Power Co because he claims the right-of-way agreement he signed with the company (for $6,000) does not empower VEPCO to let the City of Washington string lines over his farm on VEPCO's poles. He says he's entitled to "not less than $2,000" more.

Pennsylvania Eyes Niagara

Sen Joseph S. Clark (D-Pa.) has introduced a bill in Congress which, if approved, would force New York to sell a "reasonable portion" of Niagara Project power to Pennsylvania's rural co-ops.

Discuss R/W Brush Sprays

Northeastern Weed Control Conference told of herbicides for clearing rights-of-way of upland oaks and conifers

Effective methods for chemical control of mixed upland oaks and conifers on utility right-of-way were recommended at the 11th annual meeting of the Northeastern Weed Control Conference Jan. 9-11 in New York.

Herbicides Kill Oaks

Highly acceptable top kill of mixed upland oaks and associated species on right-of-way was reported for 2,4,5-TP (2,4,5-trichlorophenoxy propionic acid) and 2,4,5-TA (2,4,5-trichlorophenoxy acetic acid). Both treatments were applied during the 1954 summer as a selective stem-foliage spray at a concentration of 4 lb active ingredients per 100 gal water. Three growing seasons after spraying, the 2,4,5-TP and 2,4,5-TA had produced a 97% reduction of living plants and reduced individual stems of all species by 90% and 96%, respectively. Because of the selective nature of the spray, aimed at the more outstanding sprout clumps, it is likely that a number of the inconspicuous single seedlings and suckers were missed.

Report Experiments

This experiment was conducted on a 1,500-ft section of a 180-ft wide Pennsylvania Electric Co right-of-way by W. R. Byrnes, W. C. Bramble, and D. P. Worley of Pennsylvania State University's School of Forestry. The major species on the test area were common upland oaks, predominantly chestnut oak, red maple, and sassafras.

The study included four treatments of ATA (3-amino-1,2,4-triazole), conducted as selective foliage and broadcast foliage sprays at concentrations from 4 to 9 lb of active ingredients per 100 gal water. Generally, the ATA treatments were less effective than the 2,4,5-TP and 2,4,5-TA sprays.

Selective foliage treatment with ATA at 9 lb per 100 gal was more effective than lower rates of ATA on oaks, slightly less effective on sassafras, and inconclusive on red maple. Broadcast foliage treatment of ATA at 9 lb gave poorer results than selective treatment at the same concentration but was more effective in reducing single seedlings and suckers.

Three growing seasons after the experiment, none of the six treatments had materially affected the composition or abundance of species in the vegetative ground layer. This cover consisted predominantly of woody shrubs such as blueberry, huckleberry, mountain laurel, and bracken and sedge although to a much lesser extent.

Recommends 5 Chemicals

Chemicals for controlling deciduous woody growth usually have little effect on conifers. J. M. Bennett, Hydro-Electric Power Commission of Ontario, recommended these five herbicides as most effective for killing conifers.

1. 2,3,6-TBA (2,3,6-trichlorobenzoic acid)—4-6 lb acid equivalent per 100 Imp (Imperial) gal water (120 U.S. gal).

2. TCA (trichloroacetic acid, sodium salt)—8-10 lb acid equivalent per 100 Imp gal water.

3. Monuron (3-p-chlorophenyl-1, 1-dimethylurea)—3-4 lb active ingredient per 100 Imp gal water.

4. Dalapon (2,2-dichloropropionic acid, sodium salt)—15-20 lb acid equivalent per 100 Imp gal water.

5. Silvex (dalapon and amino triazole in 4-to1 ratio)—6-8 lb acid equivalent per 100 Imp gal water.

Conifer Tests in Canada

These recommendations were based on experiments in 1955 with 14 herbicides. The test site was an Ontario Hydro right-of-way section divided into 160 plots comprising more than 6,000 tagged stems. Applications were made with a compressed air knapsack sprayer giving complete coverage of foliage and stems.

When applied during the growing season, water-borne sprays of the five herbicides produced effective control of balsam fir and black spruce. But no treatment, except those containing oil or oil-water carrier, gave satisfactory control during April or October.

Bennett suggested 2,3,6-TBA and TCA as the most suitable materials for extensive use. This is based on effectiveness, cost, corrosiveness to equipment, effect on other vegetation, hazards in use, and ease of application.

1957 Sales Will Rise 7%, Appliance Show Is Told

Major appliance sales in 1956 topped 1955 sales by 3.2%, John C. Sharp, president of Hotpoint Inc told a press conference at the opening Jan. 7 of the annual Furniture and Appliance Show in Chicago. He predicted a 7% rise in 1957 sales.

While total sales were highest in 1956, Sharp said profits were lowest. In 1957, he said, there would be a firming of prices.

Leonard Truesdell, vice president and director of sales, Zenith Radio Corp, said that the television industry should come of age in 1957. He said it was his belief that there is a normal steady market for 6.5 to 7.5 million black-and-white receivers each year. The industry should try to make these sales in models and at prices that will provide normal and justified profits, he declared, adding that there will not be a sudden shift to color receivers.

Kelvinator's "Atoms For Living Kitchen" was presented to the public as something for the future. It featured cabinet-type food storage, each cabinet maintaining a temperature for a particular type of storage. Some were controlled at 50-55F for the storage of foods preserved by rays produced by atomic energy. An "island" unit, resembling a desk, contained an ultrasonic dishwasher and a communications center.

The "RCA Whirlpool Miracle Kitchen" featured automatic and remote control of practically everything in it. "Kitchens of the World" was the theme of Hotpoint's display "designed to show modern mass-production American appliances in surroundings of Western, Zuider Zee, and South Seas motifs".

Atomic Energy Commission Purchases of Electric Power

	Oak Ridge		Paducah				Portsmouth	
	TVA		TVA		Electric Energy Inc		Ohio Valley Electric Corp	
	Mwhr	Cost	Mwhr	Cost	Mwhr	Cost	Mwhr	Cost
1943	21,382	$86,067	.....	.....	.....	.....	.....	.....
1944	609,923	2,390,347	.....	.....	.....	.....	.....	.....
1945	1,610,480	5,524,794	.....	.....	.....	.....	.....	.....
1946	1,866,029	6,085,495	.....	.....	.....	.....	.....	.....
1947	1,616,717	5,154,455	.....	.....	.....	.....	.....	.....
1948	1,718,783	5,985,430	.....	.....	.....	.....	.....	.....
1949	1,855,150	6,454,519	.....	.....	.....	.....	.....	.....
1950	1,681,230	5,879,251	.....	.....	.....	.....	.....	.....
1951	3,113,873	15,002,569	6,684	$64,652	5,810	$50,251	.....	.....
1952	5,818,336	25,402,069	83,814	1,520,929	83,225	781,532	.....	.....
1953	5,986,815	22,032,735	2,894,665	18,671,853	2,727,703	15,425,225	.....	.....
1954	9,121,949	44,785,775	6,790,282	31,553,981	6,213,252	31,741,999	422,413	$3,384,525
1955	15,714,210	66,839,325	11,505,041	49,092,858	7,382,588	32,809,485	10,730,026	52,421,266

	Hanford		Savannah River		Fernald		Total Power Purchased	
	Bonneville Power Admin		South Carolina Generating Co		Cincinnati Gas and Electric Co			
	Mwhr	Cost	Mwhr	Cost	Mwhr	Cost	Mwhr	Cost
1943	9,481	$75,416	.....	.....	.....	.....	30,863	$161,483
1944	145,317	495,926	.....	.....	.....	.....	755,240	2,886,273
1945	416,639	1,379,505	.....	.....	.....	.....	2,027,119	6,904,299
1946	363,028	1,098,132	.....	.....	.....	.....	2,229,057	7,183,627
1947	313,702	1,100,738	.....	.....	.....	.....	1,930,419	6,255,193
1948	389,411	1,125,809	.....	.....	.....	.....	2,108,194	7,111,239
1949	473,524	1,353,077	.....	.....	.....	.....	2,328,674	7,807,596
1950	586,169	1,552,426	.....	.....	.....	.....	2,267,399	7,431,677
1951	672,080	1,736,036	.....	.....	.....	.....	3,827,266	17,160,117
1952	751,705	1,965,136	.....	.....	.....	.....	6,778,280	30,103,848
1953	936,129	2,260,506	.....	.....	.....	.....	12,606,718	59,000,183
1954	1,034,896	2,629,550	239,425	$1,421,905	.....	.....	23,822,217	115,517,735
1955	1,333,514	3,336,150	371,008	2,103,067	96,475	$810,390	47,132,862	207,412,541

Source: Reports of the AEC 1943 through 1955. Current data based on reports of electric utilities to the FPC.

New range models featured styling changes. One new feature was Philco's electro-catalyst smoke and odor inhibitor which fits like a hood over a surface unit. A heated platinum catalyst oxidizes odors as cooking vapors pass over it. Westinghouse showed the electronic ovens it announced in November and a range-top grill, a controlled-temperature unit with a 115-v, 1,600-w element cast into it.

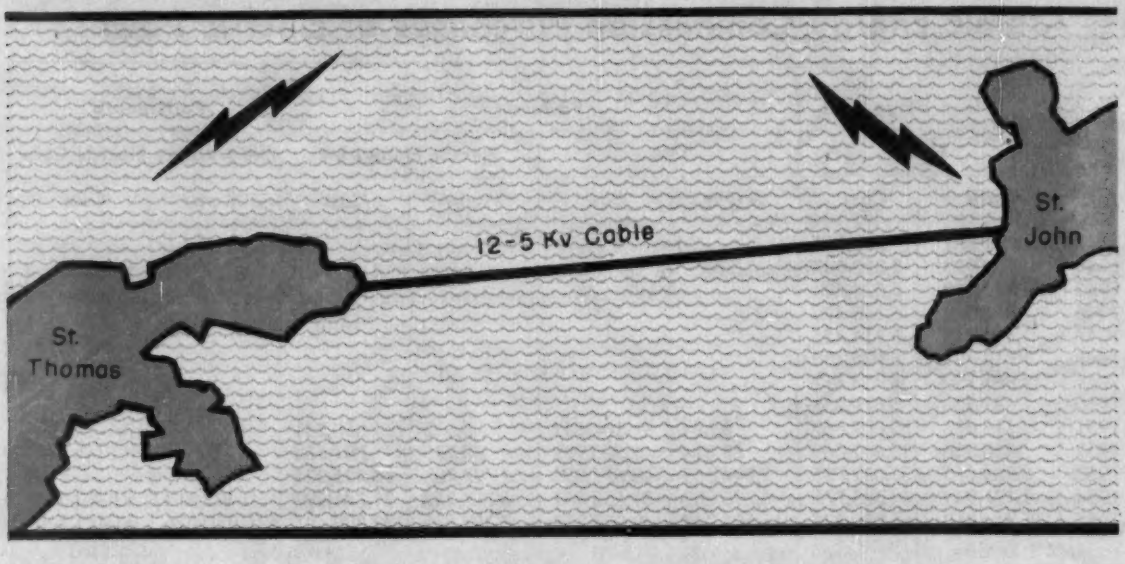
Hotpoint showed a 30-in. stack-on surface range with three surface units and a deep well.

General Electric showed ranges with a miniature circuit breaker which eliminates fuses. It also showed two dishwashers, a new 30-in. and the old 24-in. model.

Room-type air conditioners went to large sizes with 2-hp units offered by several manufacturers. One unit is intended to provide comfort for more than one room. They operate at 230 v. Philco showed a new Ionitron electrostatic filter which "generates negative ions that give marked relief for hay fever and allergy sufferers."

Oregon Taxes PUD's

Constitutionality of a 1939 Oregon statute levying ad valorem taxes on the properties of Peoples Utility Districts of the state was affirmed by the Oregon Supreme Court in a recent ruling on a test of the law by the Northern Wasco County PUD. All other PUD's have been paying taxes. Now the plaintiff PUD must pay some $50,000 for taxes assessed by Wasco County, City of The Dallas, and Oregon Tax Commission for 1950-'53 period.



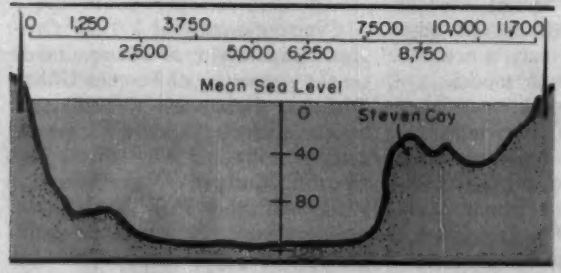
Undersea Cable Links Virgin Islands

Joining St. John and St. Thomas over 2.3 miles of rough sea floor involves use of long "tape measure," skin divers, and radio-directed LST

New 2.3-mile submarine cables bring electric service to St. John, smallest of the three main Virgin Islands, from St. Thomas, largest in the group. Stringing this cable last July involved use of a long "tape measure" and skin divers. The rugged ocean floor between the islands posed a considerable problem.

Until the four-cable 12.5-kv system was energized, the people on St. John depended on two 20-kw and a privately owned 50-kw generating unit for their electric power needs. The distribution system consisted of about 1 mile of 120/240-v line. Economy of the small 3 x 7-mile island had been mainly based on agriculture, although its natural beauty has attracted an increasing number of tourists during the postwar years.

Electric power demands have been rising, especially in the Caneel Bay area which was recently donated to the federal government for park purposes by Laurence Rockefeller. To meet these demands a large new diesel generating plant had to be built or power had to be supplied from the 4,000-kw Navy plant at Krum Bay on St. Thomas. The latter course was chosen.



PROFILE OF SEA FLOOR along cable route varies from zero to more than 100-ft along 11,700-ft distance between islands

And again there were two possible solutions: An overhead line could be built along the Cays between St. Thomas and St. John; or, a submarine cable could be laid between the islands. Economic studies showed that, although an overhead line might be cheaper, there were several navigation channels to cross which required 150-feet clearance. Further, the overhead line would be exposed to the hurricanes which historically originate in this area. For these reasons, a submarine cable was determined to offer the most reliable service.

Originally a 3-wire, 3-phase cable was considered. But because of the remoteness of St. John, it was decided to lay four separate cables to supply 12.5-kv service, using one cable as a spare. Until the fourth cable is needed to replace a faulted one, it will be used for phone service between the islands. Bids to lay the cable were awarded in December 1955.

The distance between the islands was 11,700 ft. This was determined by scaling available maps, by triangulation survey, and finally by using a long "tape measure."

In miniature the measure was a trial cable similar to those finally used. A 12-in. steel spool was mounted in a lathe and loaded with No. 20 gauge steel armature banding wire from small spools. This was measured through a dial-type wire measuring gauge. Joints were carefully made by banding and soldering so they would not hang up as they passed the guides during the laying. Paper markers were inserted in the steel

spool as it was wound every 1000 ft. These were to check progress as the wire was laid and as a check in case the wire broke. As each small spool was new and marked with its weight, this means was used to check further the length of the trial cable.

The large steel spool was mounted on a piece of 2 x 12-in. timber on the stern of a small power boat. The measuring apparatus was equipped with an adjustable brake. When all was ready, skin divers took the wire ashore on the St. Thomas end and fastened it. In 30 min after taking off along the target line, the boat reached St. John. The wire was taken ashore and fastened to the H-frame structure on that end. The remaining wire was returned to the shop and run through the wire gauge. The difference determined the amount laid.

Laying the actual cable was another matter. Originally, it was planned to lay the cables four at a time.

But available equipment was limited, so the cables were laid two at a time. An LST, assisted by an auxiliary tug, was used after being outfitted for the job.

Cabrita Point is the easternmost point or projection of St. Thomas. It is steep and rocky. Off shore are submerged rocks to which mariners give a wide berth. The cables would be pulled ashore by winch line. Radio communication was provided between each shore, the LST, and the tug. The LST and tug were to be kept on target by transits on each shore. The station on St. John was to maintain radio silence until notified by the LST that the crew could no longer hear the St. Thomas station. Then the St. John station would take over to direct the operation.

At 5 AM July 1, although weather was unfavorable, the LST anchored off Cabrita Point, and the two cables were pulled ashore. This operation required an hour. It was then decided to standby and await passage of another "very wet cloud." The wind increased and the seas heaved their worst. The tug could not put a line aboard the LST. Suddenly the anchors on the LST pulled loose.

The captain applied full power to keep off the rocks. As there was no equipment on board to reel in the cables, they were dragged across 2 miles of ocean floor back to port. The cables were re-reeled and tested. The damage done was light, mainly to the jute. On final tests these two cables showed 0.5 ma greater leakage at 70 kv than the other two.

On July 23 two cables were laid in 37 min from cast off of anchors at Cabrita Point until beaching the LST on St. John. On July 24, the last two cables were laid. This crossing required only 28 mins. The cables were laid on about 10-ft centers.

The cables are No. 4 copper insulated with 21/64 in. ozone resistant rubber. Over the corona tape are armor rods and jute. The corona tape and armor rods of all the cables are connected in parallel and form the neutral of the 7.2/12.5-kv, 3-phase, 4-wire system.

The circuit between Caneel Bay and the power plant on St. Thomas is composed of 3 miles of 1/0 copper, and 7.5 miles of No. 4 copper overhead line feeding into the 2.3 miles of No. 4 submarine cable. From the pothead on St. John, the line runs overland about 1½ miles to Caneel Bay. This line also feeds Cruz Bay. As demand requires, it will be extended.

Cabrita Point is jump-off site . . .

. . . cables go into the sea . . .

. . . LST, tug reel cable to St. John

Table I—Fluid Coke Analysis

Crude source of vacuum pitch feed	South Louisiana mixture	Hawkins	Elk Basin	
Produced by	Pilot plant	Pilot plant	Pilot plant	Carter Oil Co
Volatile matter, wt %				
At 1,100C	0.6	0.9	1.3	0.4
At 950C (1,742F)	5.0	5.0	5.3	3.8
Carbon, wt %	92.5	88.3	88.6	89.1
Hydrogen, wt %	1.6	1.9	1.8	2.1
Sulfur, wt %	1.4	7.0	6.4	6.1
Ash, wt %*	0.785	0.332	0.370	0.11
Ash components, wt %, metal in coke*				
Nickel	0.021	0.010	0.011	0.01
Vanadium	0.003	0.015	0.035	0.03
Iron	0.055	0.007	0.003	Below 0.01
Particle density, gm per cc	1.5-1.6	1.5-1.6	1.5-1.6	1.6
Bulk density, lb per cu ft	55-65	55-65	55-65	55-65
Approximate heat of combustion, Btu per lb	14,000	14,000	14,000	14,000

* Ash and ash components estimated for 100% conversion recycle operation. All other data from pilot plant tests from once-through operation.

Fluid Coke Burns Satisfactorily

GENERATION
Operation

Refinery byproduct proves to be practical fuel in utility-size boilers although only limited use of it is foreseen

DARCY CURWEN, Engineer, Mechanical Division, Stone & Webster Engineering Corp, Boston, Mass.

Fluid coke is one of two main types of petroleum coke produced as a byproduct in a refinery distilling process converting heavy fuel oil to lighter products. It is 90% carbon by weight and has a heating value of about 14,000 Btu/lb.

Of the two main types of petroleum coke, the first and better known is called "delayed coke." It has been produced for more than 25 yrs by an intermittent cyclic-bath process. The second type, "fluid coke," produced by a continuous process, is new to the refinery industry.

The results of an analysis of fluid coke vary with the source of charge to the coker unit, as illustrated in Table I. The amount of sulfur it contains is directly proportional to that in the charge. Hawkins crude from East Texas and Elk Basin crude contain a large percentage of sulfur. Coke produced from either can be expected to contain 6.4 to 7.0% sulfur. Venezuelan crude is high in both sulfur and vanadium, and coke produced from this crude contains both undesirable elements. It is possible, although not yet economical, to extract these impurities from the crude before feeding it to the coker.

In the process of which fluid coke is the residual, the particles cycle through the coker, acquiring successive layers of coke during each cycle. Microscopic examination of shattered fragments shows that the coke particles are broken up by a reversal of this process, layer by layer, because many such fragments appear as irregular segments of hollow spheres. Not only the adamantine character of the coke, but also the spherical shape of the individual particles effectively resists shattering by impact.

Delayed coke is formed differently; not being as hard, it can be pulverized as readily as many bituminous coals. When delayed coke is cut from the coke drum by hydraulic jets, it has a high moisture content which must be reduced before the coke can be burned successfully.

Delayed and fluid coke differ physically in three major ways. Delayed coke has a relatively low ignition point, a volatile matter content about one-third that of most bituminous coals, and fair grindability. Fluid coke, on the other hand, has a high ignition point, very low volatility, and poor grindability. Proximate analysis of fluid coke, delayed coke, and coal are given in Table II to indicate the differences of the fuels.

Several conventional solid-fuel handling systems can be used for transporting fluid coke. Selection of the system depends upon the distance to be traversed, the vertical lift, and whether the handling is

Table II — Analysis of Coal and Petroleum Coke

	Coal		Fluid Coke Carter Oil Co.	Delayed Coke Pan American Southern Corp.	
	High Volatile	Low Volatile	Billings, Montana	El Dorado, Arkansas	Destrahan, Louisiana
Proximate analysis, % by wt					
Moisture	3.5	2.0	0.46	9.7	5.0
Volatile matter	35.7	19.9	8.84*	11.15	11.01
Fixed carbon	51.8	70.4	91.06*	78.59	83.70
Ash	9.0	7.7	0.10*	0.56	0.29
Sulfur (separate determination)	—	—	4.35	3.89	1.64
Btu per lb	12,200-14,100		14,000-14,300	14,077	15,101
Grindability	50-100		30 approx	63	96
Ash fusion temperatures, F					
Reducing atmosphere					
Initial deformation				2,870	
Softening				2,900	
Fluid				2,900	
Oxidizing atmosphere					
Initial deformation				2,450	2,410-2,620
Softening				2,530	2,560-2,800
Fluid				2,580	2,620-2,800

* Dry basis

Table III — Precipitator Test Data Boilers Nos. 1 and 26 — Essex Generating Station, Public Service Electric and Gas Co.

Boiler No.	26	26	26	1	1	1
Boiler load	Full load	Full load	Full load	Full load	Full load	Full load
No. of pulverizers in service	1	1	2	1	1	3
Pulverized coke				*	**	***
Firing rate, tons per hr	6.78	10.44	10.42	4.02	7.07	17.74
Percentage of total fuel	30.8	43.1	45.2	12.8	21.8	51.2
Percent passing 200 mesh	76.35	51.38	88.17	96.93	86.73	90.47
Flue dust at inlet, %						
Particle size analysis						
Retained on 60 mesh sieve	0.15	0.09	0.24	—	0.54	1.08
Passed 60 mesh, retained on 100 mesh	9.01	13.27	2.60	—	3.84	7.89
Passed 100 mesh, retained on 200 mesh	27.30	43.67	21.38	—	40.03	52.50
Passed 200 mesh, retained on 325 mesh	31.06	27.08	30.38	—	30.74	23.05
Passed 325 mesh	32.48	15.89	45.40	—	24.85	15.48
Average grains per cu ft wet gas at 29.92 in. Hg and 32F	2.053	4.971	3.409	0.098	0.262	0.238
Calorific value, Btu per lb	13,296	13,348	13,177	9,172	11,396	11,854
Flue dust at outlet, %						
Particle size analysis						
Retained on 60 mesh sieve	0.45	0.05	0.30	—	0.94	—
Passed 60 mesh, retained on 100 mesh	13.34	14.25	2.65	—	7.17	—
Passed 100 mesh, retained on 200 mesh	46.30	49.05	24.34	—	53.05	—
Passed 200 mesh, retained on 325 mesh	25.76	24.90	29.10	—	20.50	—
Passed 325 mesh	14.15	11.75	43.61	—	18.34	—
Concentration						
Average grains per cu ft wet gas at 29.92 in. Hg and 32F	0.637	3.124	0.442	0.027	0.140	0.168
Calorific value, Btu per lb	13,406	13,348	12,853	—	—	—
Precipitator efficiency, %	69	37.2	87	72.4	46.6	29.4

* Lower row of burners used for coke firing ** Middle row of burners used for coke firing ***All three rows of burners used for coke firing
Data supplied by Public Service Electric & Gas Co.

continuous, as in discharge from the coker, or intermittent, as in filling trucks, railroad cars or barges. For distances up to a few thousand feet, the following are reported to be suitable:

1. Pneumatic conveyor.
2. Air slide conveyor.
3. Conventional belt conveyor.

Easy on Pneumatic System

In the pneumatic system, the coke is blown through a pipe line at high velocity. Accordingly, air or other carrying gas must be supplied at adequate pressure and flow rate, and solids must be collected at the discharge end by means of cyclone separation or bag filter. Because of its spherical shape and low ash content, fluid coke in its raw state does not cause excessive erosion in a pneumatic system.

Esso Research & Engineering Co reported a series of successful demonstrations using an air slide conveyor. The fluid-solids technique of lifting fluid coke vertically can be integrated with the air slide to convey the unpulverized material.

Coke Dust May Be Nuisance

Raw coke can be transported by conventional belt conveyors also, but belt capacity has been found to be about 50% of that normally expected in the handling of coal. Belt conveyors with a 20-deg incline have proved satisfactory for fluid coke. In continuous operation, coke dust may be a nuisance at transfer points. Although this type of transport generally has a lower power requirement than the pneumatic or air slide, it may have higher first cost.

Various Conveyors Satisfactory

Fluid coke has been transported by railroad closed hopper-bottom cement bars and unloaded over conventional track hoppers. Open dump trucks have been used for short distances. Conventional bucket elevators have transported raw fluid coke also.

Raw coke because of its small spherical shape is free flowing. It has an angle of repose at about 35 deg from the horizontal. Open storage without protection from wind and rain, such as by a tarpaulin or oil or tar spray, should not be used. The raw coke can be stored in steel tanks, like fuel oil tanks, or in bins and silos. Gravity or air slides can withdraw the material from such storage.

Because of the low volatile matter content and because most fluid coke is in the range of 30 to 100 mesh, it should be pulverized before use as fuel in a conventional steam generator furnace.

Fluid Coke Hard to Grind

The results of tests indicate that the power required to grind fluid coke is roughly 2 to 2½ times that for grinding to the same fineness a standard 55 Hardgrove grindability coal. A rough estimate of this power requirement is 35 kwhr per ton to produce a fineness of 80% through 200 mesh. Riley Stoker Corp reported that an increased mill discharge temperature has produced higher fineness and lower power requirements. Tests conducted by Allis-Chalmers Manufacturing Co in ball mills indicated that ball wear when grinding fluid coke might be about 1 lb for 1 ton of coke. Foster Wheeler Corp found that composition of ball charge affected the fineness of pulverization.

Laboratory tests indicated that fluid coke burns better than semi-anthracite but not so well as Pocahontas low-volatile bituminous coal.

Full-scale tests proved that pulverization of fluid coke to a relatively high fineness and a hot turbulent furnace are required for efficient burning of this fuel. Fineness of pulverization for the most economical operation has not been precisely determined. It is believed that the coke should be ground to a fineness of at least 75 to 85% through 200 mesh for burning without fly ash reinjection. With reinjection of fly ash, it may be possible to pulverize to a lesser fineness and obtain economical operation.

From 9% or less to 30% supplementary fuel must be burned with fluid coke to sustain ignition. The amount of supplementary fuel required is a function of the boiler and burner design. High primary air temperature increases burning efficiency. A burner design, permitting rapid heating of coke particles by the radiant heat from the flame, reduces the length of particle travel for complete combustion.

Boiler Efficiency Can Increase

Use of fluid coke does not necessarily mean a decrease in boiler efficiency. On the contrary, when properly fired, it can result in increased efficiency because of reduced hydrogen losses.

Table III gives some test results for the electrostatic precipitators at

(*Continued on page* 236)

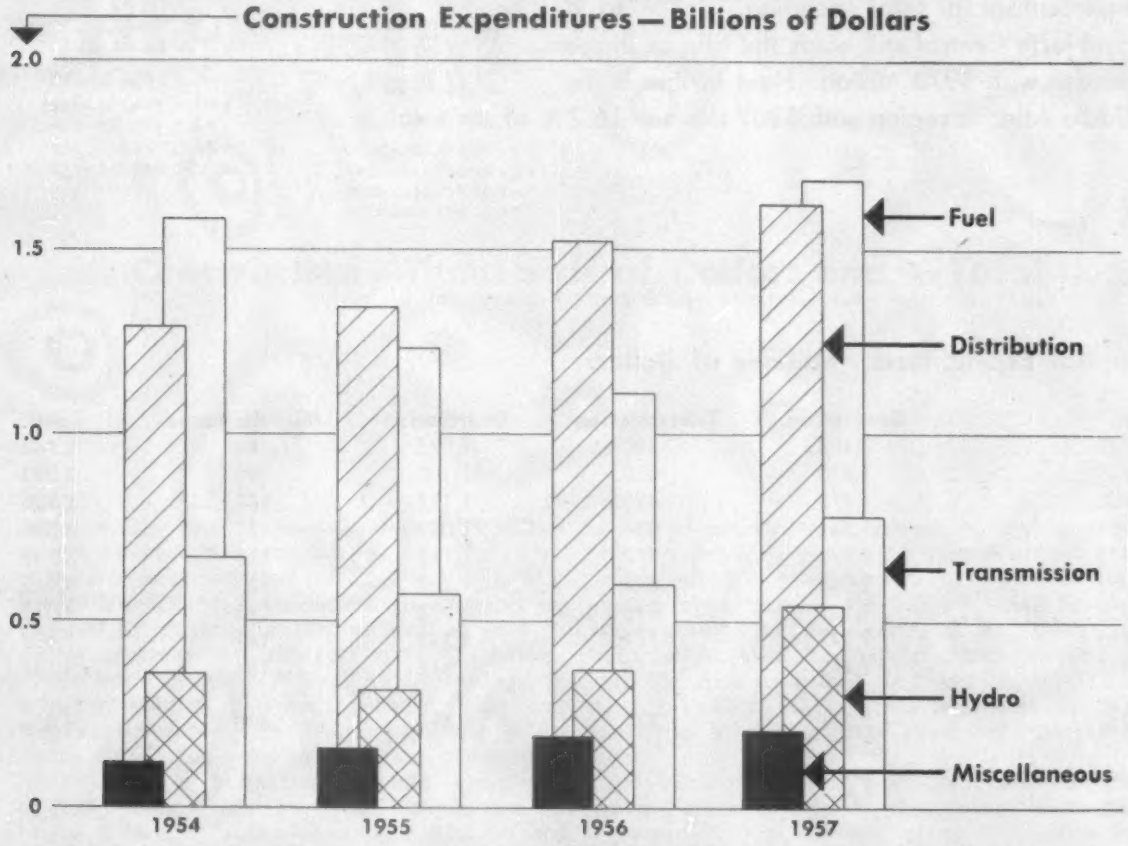
Table IV — Test Results with Mechanical Collector

Boiler Load – Full Load	
Pulverized coke	
Percentage of total fuel, average	87.4
Per cent passing 200 mesh	51.6
Flue dust at inlet, %	
Particle Size Analysis	
Over 60 microns	60.3
Over 40 but less than 60 microns	4.5
Over 30 but less than 40 microns	9.1
Over 20 but less than 30 microns	4.5
Over 15 but less than 20 microns	1.3
Over 10 but less than 15 microns	0.6
Over 7.5 but less than 10 microns	0.7
Over 0.0 but less than 7.5 microns	19.0
Concentration	
Average grains at 340F per cu ft	5.04
Flue dust into stack	
Concentration	
Average grains at 340F per cu ft.	.028*
Mechanical collector efficiency, %	90.0

* Discarded because amount of sample was too small

ELECTRICAL INDUSTRY STATISTICS

53rd Annual Report on the Electrical Industry



Utilities Budget $4.8 Billion for '57

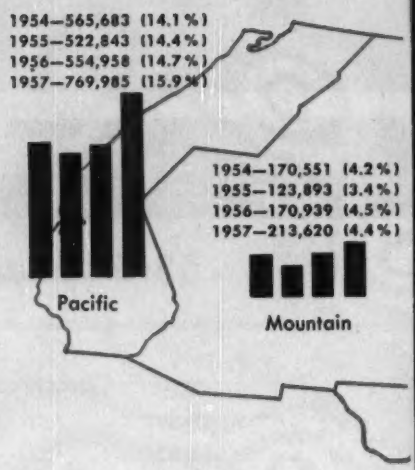
ARTHUR J. STEGEMAN, Manager, Market Research

Capital expenditures by the nation's electric utilities are scheduled to hit $4.8 billion in 1957—almost 28% more than the $3.8 billion actually spent by the industry last year.

Expenditures for generation make up better than 46% of this year's budget as against 39% in 1956. To maintain its position as the largest single item in the budget, generation spending is expected to increase almost 51% to $2.2 billion.

Following generation, transmission plant expenditures are expected to take the next biggest jump. In anticipation of the coming increase in generating ca-

BUDGET



All regions show substantial gains in 1957 budgets. Leading in percentage increases are East South Central with a 46.8% hike and West South Central with a jump of 40%. Both regions are swelled by across-the-board increases with ESC getting its biggest boost from federal construction which will increase 51% and account for 35% of the total.

Although up only 21.4% and declining slightly in percentage of total spending, 21.3% to 20.2% East North Central still holds the title of biggest spender with $978 million. Next in line is the Middle Atlantic region with $807 million—16.7% of the total.

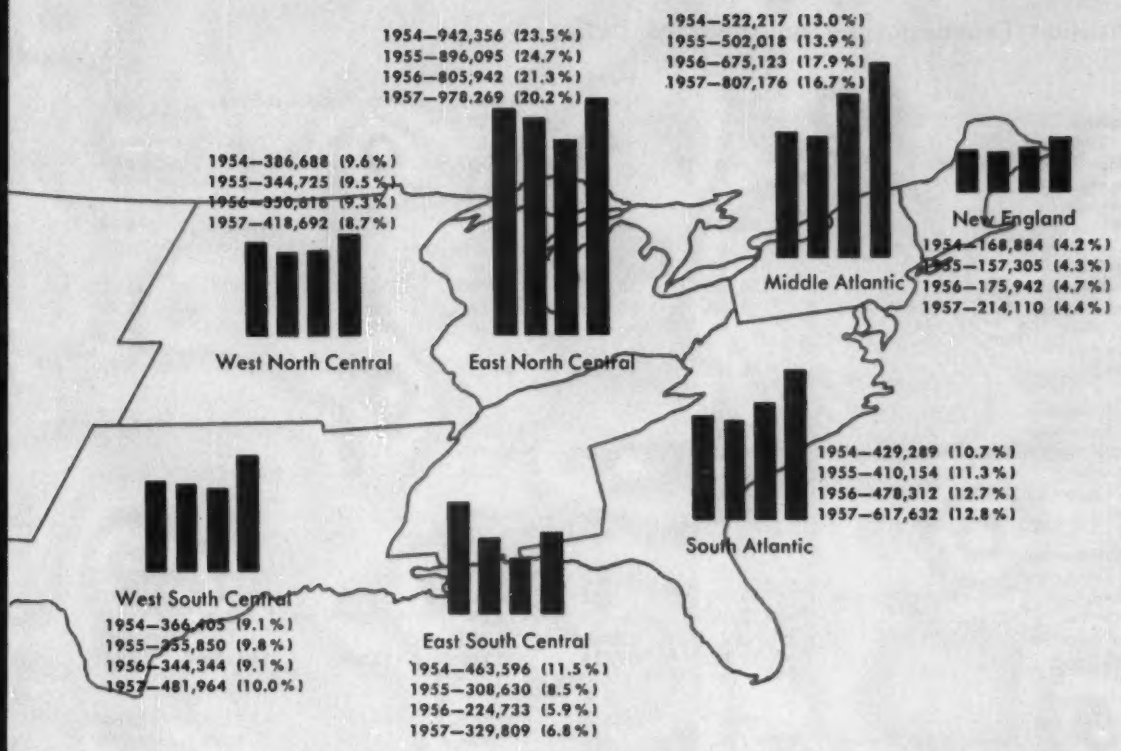
Capital Expenditures—Millions of Dollars

	Generation	Transmission	Distribution	Miscellaneous	Total
1948	1,103	400	1,075	84	2,662
1949	1,410	400	1,190	93	3,093
1950	1,275	425	1,127	109	2,936
1951	1,344	504	1,089	131	3,068
1952	1,925	577	1,118	118	3,738
1953	2,088	647	1,200	127	4,062
1954	1,939	666	1,288	122	4,015
1955	1,547	571	1,343	161	3,622
1956	1,479	598	1,518	186	3,781
1957‡	2,226	779	1,618	208	4,831

Source: Electrical World Surveys ‡ Prospective.

Coverage of Electrical World's 1956–1957 Survey

	Percentage of Group reporting on basis of:		Group's share of U. S. total	
	Capacity	Customers	Capacity	Customers
Power Companies	98.0%	96.7%	75.5%	78.8%
Municipal, State and Power District Systems	69.9%	54.0%	8.6%	13.2%
Cooperatives	36.7%	28.9%	0.7%	8.0%
Federal Agencies	100.0%	100.0%	15.3%	0.0%
All Groups	95.5%	85.6%	100.0%	100.0%



Construction—Thousands of Dollars and % Total U. S.

Source: Electrical World Surveys. All bars from left to right: 1954, 1955, 1956, 1957

pacity, utilities have budgeted a record $779 million for this one item, 30% over last year.

Distribution spending will rise 6.6% in 1957 to $1.6 billion. Expenditures in the miscellaneous category are expected to continue the climb started in 1954 by increasing almost 12% this year to $208 million.

The lion's share, or 78% of 1957's construction spending, will be by power companies. Last year they accounted for 77%. More than $1.4 billion of the $1.7 billion going into new steam generating facilities will be spent by these companies—an increase of 55%. Expenditures for hydro facilities are expected to be $235 million—more than 43% of total industry expenditures and 118% more than these companies spent last year. Private utilities will account for the bulk of transmission expenditures for which they have budgeted $611 million—an increase of almost 35% over '56. This is almost 79% of the total. Power company distribution expenditures will be better than $1.3 billion or 83% of $1.6 billion allotted to these facilities by the industry. In the miscellaneous column, the private companies lead the way by budgeting 78% or $161 million of the industry's planned expenditures for warehouses, offices, vehicles, and stores handling facilities.

Federal spending will increase by slightly under 9% this year. Allocations by federal agencies for hydro plants show a decrease of 1.8% to $160 million while spending for fuel generating facilities will increase about 59% to $69 million.

Municipal, state, and power district systems are planning to increase their total spending by 31.2% to $614 million. Cooperatives will boost their expenditures to $137 million—about 20% more than 1956.

In terms of physical quantities here's what the nation's utilities will get for their money. Generating capacity additions will add up to 9.4 million kw this year and 17.4 million in 1958. Construction of transmission lines 66 kv and above will go from 7,743 circuit miles last year to 11,024 circuit miles in '57. Lines constructed in the 22-65.9-kv class are scheduled to reach 4,251 miles as against 3,631 in 1956. Primary distribution line additions will drop from 54,267 to 52,261 pole miles. Underground transmission line construction will decline from 354 cable miles in '56 to 291 cable miles in '57. Underground distribution will increase to 2,424 cable miles from 2,225. Substation kva will increase 19.7% to 35.4 million kva.

Construction Expenditures—Thousands of Dollars

	1956					
	Fuel	Hydro	Transmission	Distribution	Miscellaneous	Total
New England						
Power Companies	41,525	8,745	21,850	86,790	10,000	168,910
Municipal, State & Power District Systems	1,036	12	887	3,966	423	6,324
Cooperatives	.....	.....	.....	617	91	708
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**42,561**	**8,757**	**22,737**	**91,373**	**10,514**	**175,942**
Middle Atlantic						
Power Companies	174,540	12,820	93,705	286,960	23,585	591,610
Municipal, State & Power District Systems	2,106	70,000	1,247	2,981	4,120	80,454
Cooperatives	.....	.....	.....	2,855	204	3,059
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**176,646**	**82,820**	**94,952**	**292,796**	**27,909**	**675,123**
East North Central						
Power Companies	297,525	1,650	115,805	282,880	49,810	747,670
Municipal, State & Power District Systems	9,108	.....	10,482	11,693	1,425	32,708
Cooperatives	13,183	.....	2,055	8,764	1,562	25,564
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**319,816**	**1,650**	**128,342**	**303,337**	**52,797**	**805,942**
West North Central						
Power Companies	41,670	175	39,490	94,355	11,275	186,965
Municipal, State & Power District Systems	43,692	152	14,969	32,106	2,684	93,603
Cooperatives	3,680	.....	2,551	5,547	953	12,731
Federal Agencies	.....	38,447	18,870	.....	.....	57,317
Total	**89,042**	**38,774**	**75,880**	**132,008**	**14,912**	**350,616**
South Atlantic						
Power Companies	148,650	1,455	62,565	184,160	15,830	412,660
Municipal, State & Power District Systems	12,702	614	424	11,379	840	25,959
Cooperatives	.....	.....	943	16,572	2,619	20,134
Federal Agencies	.....	18,849	600	.....	110	19,559
Total	**161,352**	**20,918**	**64,532**	**212,111**	**19,399**	**478,312**
East South Central						
Power Companies	28,765	1,100	14,250	35,730	4,385	84,230
Municipal, State & Power District Systems	3,215	.....	10,283	30,394	2,427	46,319
Cooperatives	.....	.....	557	13,506	3,633	17,696
Federal Agencies	43,570	13,279	16,888	.....	2,751	76,488
Total	**75,550**	**14,379**	**41,978**	**79,630**	**13,196**	**224,733**
West South Central						
Power Companies	93,470	.....	46,965	117,090	15,355	272,880
Municipal, State & Power District Systems	12,155	.....	2,437	18,524	1,109	34,225
Cooperatives	.....	.....	2,144	16,342	772	19,258
Federal Agencies	.....	17,804	167	7	3	17,981
Total	**105,625**	**17,804**	**51,713**	**151,963**	**17,239**	**344,344**
Mountain						
Power Companies	27,025	16,635	18,125	44,740	4,565	111,090
Municipal, State & Power District Systems	23,492	71	908	9,367	2,995	36,833
Cooperatives	.....	.....	3,502	7,774	699	11,975
Federal Agencies	.....	4,682	6,199	145	15	11,041
Total	**50,517**	**21,388**	**28,734**	**62,026**	**8,274**	**170,939**
Pacific						
Power Companies	68,045	65,600	42,635	141,240	16,710	334,230
Municipal, State & Power District Systems	21,171	26,217	9,594	49,728	5,151	111,861
Cooperatives	.....	.....	813	2,077	154	3,044
Federal Agencies	.....	69,975	35,848	.....	.....	105,823
Total	**89,216**	**161,792**	**88,890**	**193,045**	**22,015**	**554,958**
Total United States						
Power Companies	921,215	108,180	455,390	1,273,945	151,515	2,910,245
Municipal, State & Power District Systems	128,677	97,066	51,231	170,138	21,174	468,286
Cooperatives	16,863	.....	12,565	74,054	10,687	114,169
Federal Agencies	43,570	163,036	78,572	152	2,879	288,209
Total	**1,110,325**	**368,282**	**597,758**	**1,518,289**	**186,255**	**3,780,909**
U. S. Possessions						
Alaska	1,248	6	218	807	63	2,342
Hawaii	2,941	.....	1,941	3,242	332	8,456
Puerto Rico & Virgin Islands	5,801	2,617	2,562	5,684	1,178	17,842
Total	**9,990**	**2,623**	**4,721**	**9,733**	**1,573**	**28,640**

	1957					
	Fuel	Hydro	Transmission	Distribution	Miscellaneous	Total
New England						
Power Companies	70,670	1,655	25,990	98,315	11,445	208,070
Municipal, State & Power District Systems	1,029	8	823	3,245	427	5,532
Cooperatives	.....	.....	.....	458	50	508
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**71,699**	**1,663**	**26,813**	**102,018**	**11,922**	**214,110**
Middle Atlantic						
Power Companies	303,615	9,170	99,460	271,815	24,035	708,100
Municipal, State & Power District Systems	989	80,000	7,219	3,053	4,122	95,383
Cooperatives	.....	.....	108	3,463	122	3,693
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**304,604**	**89,170**	**106,787**	**278,331**	**28,279**	**807,176**
East North Central						
Power Companies	414,130	1,745	154,125	289,595	44,190	903,785
Municipal, State & Power District Systems	13,958	.....	5,600	20,101	1,130	40,789
Cooperatives	20,703	.....	2,667	8,884	1,441	33,695
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**448,791**	**1,745**	**162,392**	**318,580**	**46,761**	**978,269**
West North Central						
Power Companies	84,565	415	44,905	104,280	15,585	249,750
Municipal, State & Power District Systems	32,444	.....	18,981	41,712	3,399	96,536
Cooperatives	5,600	.....	4,625	5,982	1,987	18,194
Federal Agencies	.....	45,845	8,367	.....	.....	54,212
Total	**122,609**	**46,260**	**76,878**	**151,974**	**20,971**	**418,692**
South Atlantic						
Power Companies	220,905	4,585	94,140	207,555	18,280	545,465
Municipal, State & Power District Systems	23,823	81	1,948	10,130	1,998	37,980
Cooperatives	.....	.....	1,862	14,368	2,761	18,991
Federal Agencies	.....	13,566	1,720	.....	110	15,396
Total	**244,728**	**18,232**	**99,670**	**232,053**	**23,149**	**617,632**
East South Central						
Power Companies	39,860	4,495	23,610	35,215	6,800	109,980
Municipal, State & Power District Systems	33,775	.....	16,317	30,483	2,070	82,645
Cooperatives	.....	.....	2,353	16,760	2,506	21,619
Federal Agencies	69,332	12,753	29,790	.....	3,690	115,565
Total	**142,967**	**17,248**	**72,070**	**82,458**	**15,066**	**329,809**
West South Central						
Power Companies	162,645	.....	75,890	126,235	17,425	382,195
Municipal, State & Power District Systems	23,169	.....	4,007	21,165	1,698	50,039
Cooperatives	.....	.....	4,993	16,534	1,109	22,636
Federal Agencies	.....	25,967	1,110	12	5	27,094
Total	**185,814**	**25,967**	**86,000**	**163,946**	**20,237**	**481,964**
Mountain						
Power Companies	34,580	41,360	24,645	50,915	4,400	155,900
Municipal, State & Power District Systems	16,924	60	2,085	12,952	2,304	34,325
Cooperatives	.....	.....	3,114	11,535	854	15 503
Federal Agencies	.....	5,097	2,625	160	10	7,892
Total	**51,504**	**46,517**	**32,469**	**75,562**	**7,568**	**213,620**
Pacific						
Power Companies	92,340	171,775	68,635	152,340	19,280	504,370
Municipal, State & Power District Systems	19,448	66,541	10,808	59,720	14,495	171,012
Cooperatives	.....	.....	190	1,321	258	1,769
Federal Agencies	.....	56,873	35,961	.....	.....	92,834
Total	**111,788**	**295,189**	**115,594**	**213,381**	**34,033**	**769,985**
Total United States						
Power Companies	1,423,310	235,200	611,400	1,336,265	161,440	3,767,615
Municipal, State & Power District Systems	165,559	146,690	67,788	202,561	31,643	614,241
Cooperatives	26,303	.....	19,912	79,305	11,088	136,608
Federal Agencies	69,332	160,101	79,573	172	3,815	312,993
Total	**1,684,504**	**541,991**	**778,673**	**1,618,303**	**207,986**	**4,831,457**
U. S. Possessions						
Alaska	1,652	707	441	1,283	76	4,159
Hawaii	5,557	20	1,784	3,907	373	11,641
Puerto Rico & Virgin Islands	15,281	1,541	4,614	9,259	1,917	32,612
Total	**22,490**	**2,268**	**6,839**	**14,449**	**2,366**	**48,412**

Transmission and Distribution Construction

1956

	Transmission Circuit Miles		Underground Cable Miles		Primary Distribution Pole Miles		Substations
	66Kv & Up	22–65.9 Kv	Trans-mission	Distri-bution	Total	Rural	Kva
New England							
Power Companies	138	143	14	263	703	88	1,124,000
Municipal, State & Power District Systems	4	7	1	36	79	16	53,000
Cooperatives	.....	.....	...	.....	66	66	.....
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**142**	**150**	**15**	**299**	**848**	**170**	**1,177,000**
Middle Atlantic							
Power Companies	464	402	166	1,008	3,341	946	2,990,000
Municipal, State & Power District Systems	.....	.....	2	.....	107	.....	32,000
Cooperatives	.....	.....	...	.....	390	390	14,000
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**464**	**402**	**168**	**1,008**	**3,838**	**1,336**	**3,036,000**
East North Central							
Power Companies	1,165	755	78	76	5,483	1,133	5,419,000
Municipal, State & Power District Systems	23	8	29	33	173	43	160,000
Cooperatives	83	21	...	.....	1,083	1,083	54,420
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**1,271**	**784**	**107**	**109**	**6,739**	**2,259**	**5,633,420**
West North Central							
Power Companies	703	428	2	87	2,021	736	1,889,000
Municipal, State & Power District Systems	295	136	...	48	944	740	605,000
Cooperatives	154	183	13	.....	3,848	3,848	48,187
Federal Agencies	171	.....	...	.....	.....	.....	610,000
Total	**1,323**	**747**	**15**	**135**	**6,793**	**5,324**	**3,152,187**
South Atlantic							
Power Companies	919	193	14	88	6,161	1,738	2,295,000
Municipal, State & Power District Systems	3	12	...	75	1,768	279	91,000
Cooperatives	.....	169	...	.....	3,145	3,145	101,440
Federal Agencies	.....	.....	...	.....	.....	.....	39,000
Total	**922**	**374**	**14**	**163**	**11,074**	**5,162**	**2,526,440**
East South Central							
Power Companies	216	149	1	2	347	813	905,000
Municipal, State & Power District Systems	48	29	...	93	863	339	442,000
Cooperatives	33	25	...	.....	2,749	2,749	63,760
Federal Agencies	375	50	...	.....	.....	.....	1,608,000
Total	**672**	**253**	**1**	**95**	**3,959**	**3,901**	**3,018,760**
West South Central							
Power Companies	966	70	2	122	4,076	1,744	3,615,000
Municipal, State & Power District Systems	98	.....	...	54	505	19	216,000
Cooperatives	87	296	...	.....	7,119	7,119	74,153
Federal Agencies	.....	.....	...	.....	.....	12	12,000
Total	**1,151**	**366**	**2**	**176**	**11,700**	**8,894**	**3,917,153**
Mountain							
Power Companies	481	142	...	30	1,697	632	725,000
Municipal, State & Power District Systems	12	44	...	5	422	24	66,000
Cooperatives	175	86	...	1	2,538	2,538	89,000
Federal Agencies	17	.....	...	.....	8	7	387,000
Total	**685**	**272**	**...**	**36**	**4,665**	**3,201**	**1,267,000**
Pacific							
Power Companies	602	120	...	143	3,528	902	1,709,000
Municipal, State & Power District Systems	132	135	32	61	747	287	1,077,000
Cooperatives	64	28	...	.....	356	356	9,333
Federal Agencies	315	.....	...	.....	.....	.....	3,071,000
Total	**1,113**	**283**	**32**	**204**	**4,631**	**1,545**	**5,866,333**
Total United States							
Power Companies	5,654	2,402	277	1,819	27,357	8,732	20,671,000
Municipal, State & Power District Systems	615	371	64	405	5,608	1,747	2,742,000
Cooperatives	596	808	13	1	21,294	21,294	454,293
Federal Agencies	878	50	...	.....	8	19	5,727,000
Total	**7,743**	**3,631**	**354**	**2,225**	**54,267**	**31,792**	**29,594,293**
U. S. Possessions							
Alaska	.....	16	...	9	59	2	5,714
Hawaii	46	7	3	18	31	18	30,586
Puerto Rico & Virgin Islands	24	20	6	.....	299	160	45,250
Total	**70**	**43**	**9**	**27**	**389**	**180**	**81,550**

1957

	Transmission Circuit Miles		Underground Cable Miles		Primary Distribution Pole Miles		Substations
	66 Kv & UP	22–65.9 Kv	Transmission	Distribution	Total	Rural	Kva
New England							
Power Companies	107	161	32	227	609	63	1,334,000
Municipal, State & Power District Systems	4	.....	1	28	51	11	64,000
Cooperatives	.....	.....	...	.....	54	54	.....
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**111**	**161**	**33**	**255**	**714**	**128**	**1,398,000**
Middle Atlantic							
Power Companies	630	440	96	1,000	3,174	815	3,439,000
Municipal, State & Power District Systems	75	.....	...	1	109	.....	276,000
Cooperatives	.....	18	...	.....	360	360	5,600
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**705**	**458**	**96**	**1,001**	**3,643**	**1,175**	**3,720,600**
East North Central							
Power Companies	1,722	900	71	308	5,496	1,079	6,855,000
Municipal, State & Power District Systems	48	25	5	20	197	30	313,000
Cooperatives	62	60	...	.....	1,207	1,207	146,192
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**1,832**	**985**	**76**	**328**	**6,900**	**2,316**	**7,314,192**
West North Central							
Power Companies	906	389	3	54	1,928	779	2,278,000
Municipal, State & Power District Systems	259	249	1	49	864	693	1,070,000
Cooperatives	297	122	13	.....	3,501	3,501	169,680
Federal Agencies	161	.....	...	.....	.....	.....	362,000
Total	**1,623**	**760**	**17**	**103**	**6,293**	**4,973**	**3,879,680**
South Atlantic							
Power Companies	1,213	198	36	97	6,144	1,690	4,996,000
Municipal, State & Power District Systems	19	8	...	76	1,186	253	220,000
Cooperatives	.....	227	...	.....	3,320	3,320	80,110
Federal Agencies	.....	.....	...	.....	.....	.....	112,000
Total	**1,232**	**433**	**36**	**173**	**10,650**	**5,263**	**5,408,110**
East South Central							
Power Companies	378	123	1	.....	382	633	744,000
Municipal, State & Power District Systems	62	15	...	76	727	267	442,000
Cooperatives	57	182	...	.....	2,846	2,846	152,166
Federal Agencies	425	50	...	.....	.....	.....	1,519,000
Total	**922**	**370**	**1**	**76**	**3,955**	**3,746**	**2,757,166**
West South Central							
Power Companies	1,523	101	...	53	4,207	1,570	3,450,000
Municipal, State & Power District Systems	72	.....	8	31	493	13	200,000
Cooperatives	246	346	...	.....	6,535	6,535	62,160
Federal Agencies	.....	.....	...	.....	.....	20	12,000
Total	**1,841**	**447**	**8**	**84**	**11,235**	**8,138**	**3,724,160**
Mountain							
Power Companies	778	147	...	37	1,734	598	2,238,000
Municipal, State & Power District Systems	88	7	...	5	457	24	168,000
Cooperatives	179	143	...	15	2,461	2,461	122,660
Federal Agencies	237	.....	...	10	8	.....	334,000
Total	**1,282**	**297**	**...**	**67**	**4,660**	**3,083**	**2,862,660**
Pacific							
Power Companies	1,048	196	4	228	3,158	940	204,000
Municipal, State & Power District Systems	178	137	20	109	774	264	1,238,000
Cooperatives	.....	7	...	.....	279	279	7,333
Federal Agencies	250	.....	...	.....	.....	.....	2,912,000
Total	**1,476**	**340**	**24**	**337**	**4,211**	**1,483**	**4,361,333**
Total United States							
Power Companies	8,305	2,655	243	2,004	26,832	8,167	25,538,000
Municipal, State & Power District Systems	805	441	35	395	4,858	1,555	3,991,000
Cooperatives	841	1,105	13	15	20,563	20,563	645,901
Federal Agencies	1,073	50	...	10	8	20	5,251,000
Total	**11,024**	**4,251**	**291**	**2,424**	**52,261**	**30,305**	**35,425,901**
U. S. Possessions							
Alaska	.....	18	...	8	121	2	20,250
Hawaii	72	6	2	34	43	30	124,734
Puerto Rico & Virgin Islands	64	22	...	.....	306	150	66,000
Total	**136**	**46**	**2**	**42**	**470**	**182**	**210,984**

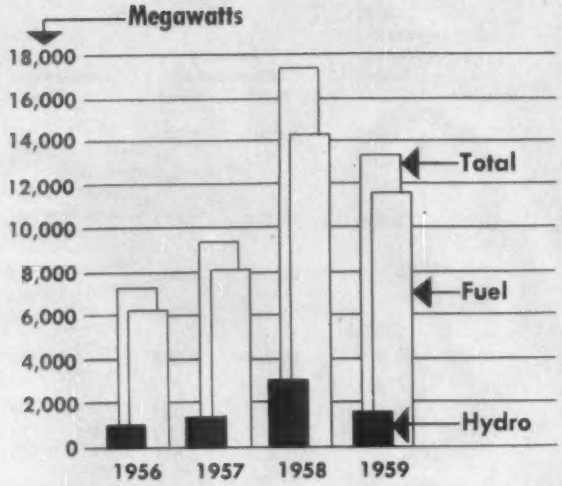
Transmission and Distribution Expenditures—Thousands of Dollars

	Transmission Lines		1956 Underground Construction		Primary Distribution		
	66 Kv & Up	22–65.9 Kv	Transmission	Distribution	Total	Rural	Substations Kva
New England							
Power Companies	4,360	2,660	1,350	5,449	12,975	305	12,830
Municipal, State & Power District Systems	23	86	10	100	509	34	924
Cooperatives	.....	.....	.....	.....	198	198	.....
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**4,383**	**2,746**	**1,360**	**5,549**	**13,682**	**537**	**13,754**
Middle Atlantic							
Power Companies	14,130	8,175	17,028	30,600	49,205	5,330	56,740
Municipal, State & Power District Systems	250	.....	91	11	328	.....	664
Cooperatives	.....	.....	.....	.....	1,288	1,288	319
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**14,380**	**8,175**	**17,119**	**30,611**	**50,821**	**6,618**	**57,723**
East North Central							
Power Companies	32,350	13,460	6,295	13,109	71,400	8,230	91,955
Municipal, State & Power District Systems	15	84	4,262	803	1,510	90	3,073
Cooperatives	1,231	216	.....	.....	3,119	3,119	1,034
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**33,596**	**13,760**	**10,557**	**13,912**	**76,029**	**11,439**	**96,062**
West North Central							
Power Companies	15,665	3,590	.....	1,317	32,030	2,350	24,015
Municipal, State & Power District Systems	3,940	873	41	855	9,256	3,470	10,548
Cooperatives	1,313	562	25	.....	3,866	3,866	771
Federal Agencies	11,137	.....	.....	.....	.....	.....	7,733
Total	**32,055**	**5,025**	**66**	**2,172**	**45,152**	**9,686**	**43,067**
South Atlantic							
Power Companies	19,415	5,810	5,130	6,373	82,540	12,065	39,925
Municipal, State & Power District Systems	.....	151	.....	226	4,651	532	966
Cooperatives	.....	890	.....	.....	6,854	6,854	2,536
Federal Agencies	.....	.....	.....	.....	.....	.....	600
Total	**19,415**	**6,851**	**5,130**	**6,599**	**94,045**	**19,451**	**44,027**
East South Central							
Power Companies	5,265	1,680	55	3,781	6,710	575	10,200
Municipal, State & Power District Systems	1,277	471	.....	566	9,226	1,755	5,288
Cooperatives	173	109	.....	.....	6,139	6,139	1,594
Federal Agencies	6,000	850	.....	.....	.....	.....	9,497
Total	**12,715**	**3,110**	**55**	**4,347**	**22,075**	**8,469**	**26,579**
West South Central							
Power Companies	18,705	1,150	400	8,869	29,275	4,700	24,010
Municipal, State & Power District Systems	1,255	.....	.....	647	5,731	61	1,946
Cooperatives	261	1,140	.....	.....	15,216	15,216	964
Federal Agencies	.....	.....	.....	.....	.....	13	12
Total	**20,221**	**2,290**	**400**	**9,516**	**50,222**	**19,990**	**26,932**
Mountain							
Power Companies	7,985	1,465	.....	729	11,390	1,000	9,360
Municipal, State & Power District Systems	207	257	.....	8	1,468	72	1,316
Cooperatives	792	527	.....	.....	4,573	4,573	2,142
Federal Agencies	4,184	.....	.....	.....	25	21	1,950
Total	**13,168**	**2,249**	.....	**737**	**17,456**	**5,666**	**14,768**
Pacific							
Power Companies	13,550	1,360	.....	5,503	43,140	4,505	26,920
Municipal, State & Power District Systems	1,575	1,469	1,784	3,984	11,731	1,511	15,953
Cooperatives	293	117	.....	.....	1,017	1,017	112
Federal Agencies	19,000	.....	.....	.....	.....	.....	16,848
Total	**34,418**	**2,946**	**1,784**	**9,487**	**55,888**	**7,033**	**59,833**
Total United States							
Power Companies	131,425	39,350	30,258	75,730	338,665	39,060	295,955
Municipal, State & Power District Systems	8,542	3,391	6,188	7,200	44,410	7,525	40,678
Cooperatives	4,063	[3,561	25	.....	42,270	42,270	9,472
Federal Agencies	40,321	850	.....	.....	25	34	36,640
Total	**184,351**	**47,152**	**36,471**	**82,930**	**425,370**	**88,889**	**382,745**
U. S. Possessions							
Alaska	.....	162	.....	137	449	6	81
Hawaii	873	48	208	470	844	90	374
Puerto Rico & Virgin Islands	509	370	1,378	.....	4,612	1,908	518
Total	**1,382**	**580**	**1,586**	**607**	**5,905**	**2,004**	**973**

	Transmission Lines		1957 Underground Construction		Primary Distribution		Substations
	66 Kv & Up	22–65.9 Kv	Trans-mission	Distri-bution	Total	Rural	Kva
New England							
Power Companies	5,525	4,785	1,433	5,460	11,200	1,570	11,605
Municipal, State & Power District Systems	23	.....	30	106	432	38	878
Cooperatives	.....	.....	.....	.....	164	164	.....
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**5,548**	**4,785**	**1,463**	**5,566**	**11,796**	**1,772**	**12,483**
Middle Atlantic							
Power Companies	30,135	10,900	13,400	31,865	48,580	5,085	55,595
Municipal, State & Power District Systems	2,500	.....	.....	14	481	.....	5,596
Cooperatives	.....	108	.....	.....	1,188	1,188	155
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**32,635**	**11,008**	**13,400**	**31,879**	**50,249**	**6,273**	**61,346**
East North Central							
Power Companies	54,035	14,435	8,941	10,013	60,825	4,035	108,850
Municipal, State & Power District Systems	762	279	230	1,225	1,838	70	5,136
Cooperatives	634	350	.....	.....	3,651	3,651	1,500
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**55,431**	**15,064**	**9,171**	**11,238**	**66,314**	**7,756**	**115,486**
West North Central							
Power Companies	17,940	4,830	200	851	29,660	2,350	28,830
Municipal, State & Power District Systems	5,470	1,189	10	532	8,902	3,383	17,798
Cooperatives	2,292	497	27	.....	3,596	3,596	3,224
Federal Agencies	6,100	.....	.....	.....	.....	.....	2,267
Total	**31,802**	**6,516**	**237**	**1,383**	**42,158**	**9,329**	**52,119**
South Atlantic							
Power Companies	34,730	5,670	7,701	7,534	100,290	14,205	58,410
Municipal, State & Power District Systems	572	70	.....	208	3,591	446	3,017
Cooperatives	.....	1,708	.....	.....	7,025	7,025	2,083
Federal Agencies	.....	.....	.....	.....	.....	.....	1,720
Total	**35,302**	**7,448**	**7,701**	**7,742**	**110,906**	**21,676**	**65,230**
East South Central							
Power Companies	9,590	2,020	66	3,813	6,600	625	12,400
Municipal, State & Power District Systems	2,663	327	.....	1,908	9,725	1,529	5,309
Cooperatives	399	1,282	.....	.....	7,618	7,618	939
Federal Agencies	9,900	800	.....	.....	.....	.....	18,456
Total	**22,552**	**4,429**	**66**	**5,721**	**23,943**	**9,772**	**37,104**
West South Central							
Power Companies	35,485	1,065	.....	11,376	28,345	4,440	31,085
Municipal, State & Power District Systems	2,081	.....	36	350	6,971	50	2,249
Cooperatives	1,420	1,354	.....	.....	14,483	14,483	1,554
Federal Agencies	.....	.....	.....	.....	.....	20	12
Total	**38,986**	**2,419**	**36**	**11,726**	**49,799**	**18,993**	**34,900**
Mountain							
Power Companies	16,815	2,110	.....	921	11,370	1,370	17,540
Municipal, State & Power District Systems	1,151	37	.....	8	1,424	72	2,476
Cooperatives	1,200	554	.....	.....	4,614	4,614	2,944
Federal Agencies	945	.....	.....	30	24	.....	1,650
Total	**20,111**	**2,701**	.....	**959**	**17,432**	**6,056**	**24,610**
Pacific							
Power Companies	26,340	2,165	143	6,191	38,755	4,545	35,320
Municipal, State & Power District Systems	6,752	2,040	1,832	4,298	13,160	1,436	16,916
Cooperatives	.....	38	.....	.....	792	792	242
Federal Agencies	18,000	.....	.....	.....	.....	.....	17,961
Total	**51,092**	**4,243**	**1,975**	**10,489**	**52,707**	**6,773**	**70,439**
Total United States							
Power Companies	230,595	47,980	31,884	78,024	335,625	38,225	359,635
Municipal, State & Power District Systems	21,974	3,942	2,138	8,649	46,524	7,024	59,375
Cooperatives	5,945	5,891	27	.....	43,131	43,131	12,641
Federal Agencies	34,945	800	.....	30	24	20	42,066
Total	**293,459**	**58,613**	**34,049**	**86,703**	**425,304**	**88,400**	**473,717**
U. S. Possessions							
Alaska	.....	162	.....	251	871	6	406
Hawaii	1,075	51	130	570	830	150	1,385
Puerto Rico & Virgin Islands	2,253	1,961	.....	.....	8,468	3,155	750
Total	**3,328**	**2,174**	**130**	**821**	**10,169**	**3,311**	**2,541**

MAINTENANCE

Capacity Additions—Megawatts



	1956	1957	1958	1959
Hydro.....	1,057	1,298	3,005	1,560
Steam.....	6,218	8,052	14,303	11,722
IC.....	29	85	44	19
Total.....	**7,304**	**9,435**	**17,351**	**13,300**

Source: Electrical World Surveys.

Transmission & Distribution Line Construction

(Mileage and Kva)

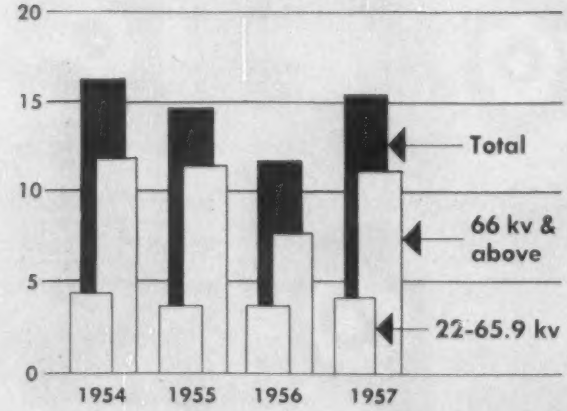
	1954	1955	1956	1957
Transmission Lines—Circuit Miles				
66 kv and above.....	11,828	11,262	7,743	11,024
22–65.9 kv.....	4,373	3,593	3,631	4,251
Primary Distribution Lines—Pole Miles				
Total.....	66,729	56,519	54,267	52,261
Rural.....	48,437	34,906	31,792	30,305
Underground Construction—Cable Miles				
Transmission.....	429	349	354	291
Distribution.....	2,454	1,690	2,225	2,424
Substations—Thousands of Kva....	34,202	30,768	29,594	35,426

Source: Electrical World Surveys.

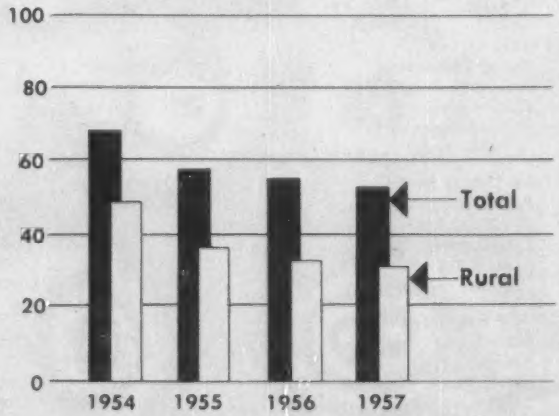
(Millions of Dollars)

	1954	1955	1956	1957
Transmission Lines				
66 kv and above.....	233	197	184	293
22–65.9 kv.....	50	43	47	59
Primary Distribution Lines				
Total.....	457	425	425	425
Rural.....	150	114	89	88
Underground Construction				
Transmission.....	28	27	36	34
Distribution.....	94	64	83	87
Substations.....	412	362	383	474

Transmission Line Construction — Thousands of Circuit Miles



Primary Distribution Line Construction — Thousands of Pole Miles

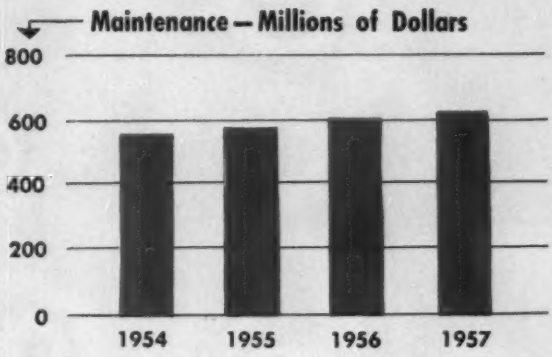


Maintenance Will Cost $630 Million

Electric utilities have allocated $630 million to maintenance in 1957. This is $23 million more than in 1956 and represents an increase of nearly 4%.

Power companies will spend 82% of the total, with municipal, state, and power district groups accounting for 8.8% and cooperatives and federal agencies splitting the remaining 9% about equally between them. There is little significant change in this pattern compared with 1956.

About $304 million or 48% of the industry's maintenance appropriation will be expended in the Middle Atlantic and East North Central states.



Maintenance — Thousands of Dollars

	1956	1957
New England		
Power Companies	23,650	33,080
Municipal, State & Power District Systems	938	1,007
Cooperatives	32	32
Federal Agencies	.....	.....
Total	**24,620**	**34,119**
Middle Atlantic		
Power Companies	162,025	168,700
Municipal, State & Power District Systems	860	852
Cooperatives	420	463
Federal Agencies	.....	.....
Total	**163,305**	**170,015**
East North Central		
Power Companies	129,195	122,525
Municipal, State & Power District Systems	9,084	7,642
Cooperatives	3,694	4,046
Federal Agencies	35	35
Total	**142,008**	**134,248**
West North Central		
Power Companies	32,755	33,675
Municipal, State & Power District Systems	9,345	8,439
Cooperatives	8,250	8,308
Federal Agencies	528	545
Total	**50,878**	**50,967**
South Atlantic		
Power Companies	59,400	61,765
Municipal, State & Power District Systems	2,104	2,074
Cooperatives	3,417	3,725
Federal Agencies	205	230
Total	**65,126**	**67,794**

	1956	1957
East South Central		
Power Companies	13,660	14,765
Municipal, State & Power District Systems	6,339	6,605
Cooperatives	2,665	2,985
Federal Agencies	13,668	14,396
Total	**36,332**	**38,751**
West South Central		
Power Companies	31,925	34,220
Municipal, State & Power District Systems	3,355	3,215
Cooperatives	4,825	5,630
Federal Agencies	606	665
Total	**40,711**	**43,730**
Mountain		
Power Companies	10,935	11,395
Municipal, State & Power District Systems	1,723	1,979
Cooperatives	2,293	2,761
Federal Agencies	2,713	2,825
Total	**17,664**	**18,960**
Pacific		
Power Companies	33,475	36,410
Municipal, State & Power District Systems	22,404	23,835
Cooperatives	559	609
Federal Agencies	9,382	10,418
Total	**65,820**	**71,272**
Total United States		
Power Companies	497,020	516,535
Municipal, State & Power District Systems	56,152	55,648
Cooperatives	26,155	28,559
Federal Agencies	27,137	29,114
Total	**606,464**	**629,856**

U. S. Possessions

Alaska	497	582
Hawaii	1,937	1,965
Puerto Rico & Virgin Islands	2,347	2,699
Total	**4,781**	**5,246**

Canada Budgets $485 Million

Utility industry in Canada plans to spend $485 million this year, a jump of $21 million over last year's $464 million. Of $281 million for generation hydro will get 75.8%

Canada's planned capital expenditures in 1957 add up to $485 million, an increase of $21 million or 4.5% over last year's $464. This year, like last, generation is the biggest single item, accounting for $281 million or 58% of the total appropriated. But, whereas

	Total Canada	Nfld. &† PEI	Nova Scotia	New Brunswick	Quebec	Ontario
Electric Plant Construction—Thousands of Dollars						
Fuel 1956	35,831	950	2,601	2,000	.....	1,800
1957	67,940	425	3,500	700	.....	25,000
Hydro 1956	198,086	1,415	1,487	12,000	43,468	118,902
1957	213,325	1,200	2,850	11,000	45,000	121,165
Transmission 1956	110,549	457	1,921	3,700	45,243	25,835
1957	81,125	874	2,584	4,000	12,445	37,050
Distribution 1956	94,844	870	2,066	780	24,613	34,770
1957	98 437	1,066	1,529	754	27,158	34,553
Miscellaneous 1956	24,325	100	527	1,300	3,246	2,711
1957	23,915	400	1,268	2,054	2,047	3,328
Total 1956	463,635	3,792	8,602	19,780	116,570	184,018
1957	484,742	3,965	11,731	18,508	86,650	221,096
Maintenance—Thousands of Dollars						
1956	46,564	1,027	1 274	2,690	6,170	22,414
1957	50,403	1,095	1,364	2,054	7,143	23,964
Line & Substation Construction—Thousands of Dollars						
Transmission Line						
66 Kv & Up 1956	63,720	288	724	3,000	39,247	6,400
1957	36,609	127	827	3,000	8,500	11,500
22–65.9 Kv 1956	7,248	35	30	.....	98	3,668
1957	5,652	30	142	.....	6	3,477
Underground						
Transmission 1956	7,832	.....	115	.....	.....	2,517
1957	2,937	.....	.....	.....	.....	2,900
Distribution 1956	5,987	.....	92	.....	4,293	1,076
1957	4,955	.....	5	.....	2,844	1,096
Primary Distribution Line						
Total 1956	40,636	240	727	390	1,192	23,680
1957	41,697	407	355	390	1,249	24,968
Rural 1956	31,786	223	346	300	570	21,506
1957	33,167	327	277	390	509	23,013
Substations 1956	37,541	64	191	910	5,077	16,087
1957	36,162	77	392	1,000	4,185	21,685
Line & Substation Construction						
Transmission Line—Circuit Miles						
66 Kv & Up 1956	1,698	32	93	190	605	263
1957	1,279	12	90	120	184	287
22–65.9 Kv 1956	996	7	5	.....	23	155
1957	720	2	26	.....	20	160
Underground—Cable Miles						
Transmission 1956	30	.....	1	.....	.....	9
1957	15	.....	.....	.....	.....	14
Distribution 1956	272	.....	2	.....	170	78
1957	249	.....	1	.....	132	77
Primary Distribution—Pole Miles						
Total 1956	13,022	116	222	156	414	997
1957	12,853	162	136	156	436	1,183
Rural 1956	10,020	113	124	156	240	856
1957	9,754	156	99	156	224	1,078
Substation—Thousands of Kva						
1956	5,096	10	25	91	1,961	1,110
1957	6,574	8	67	100	1,452	2,904

†Estimated by Electrical World

for '57, Generation Totals 58%

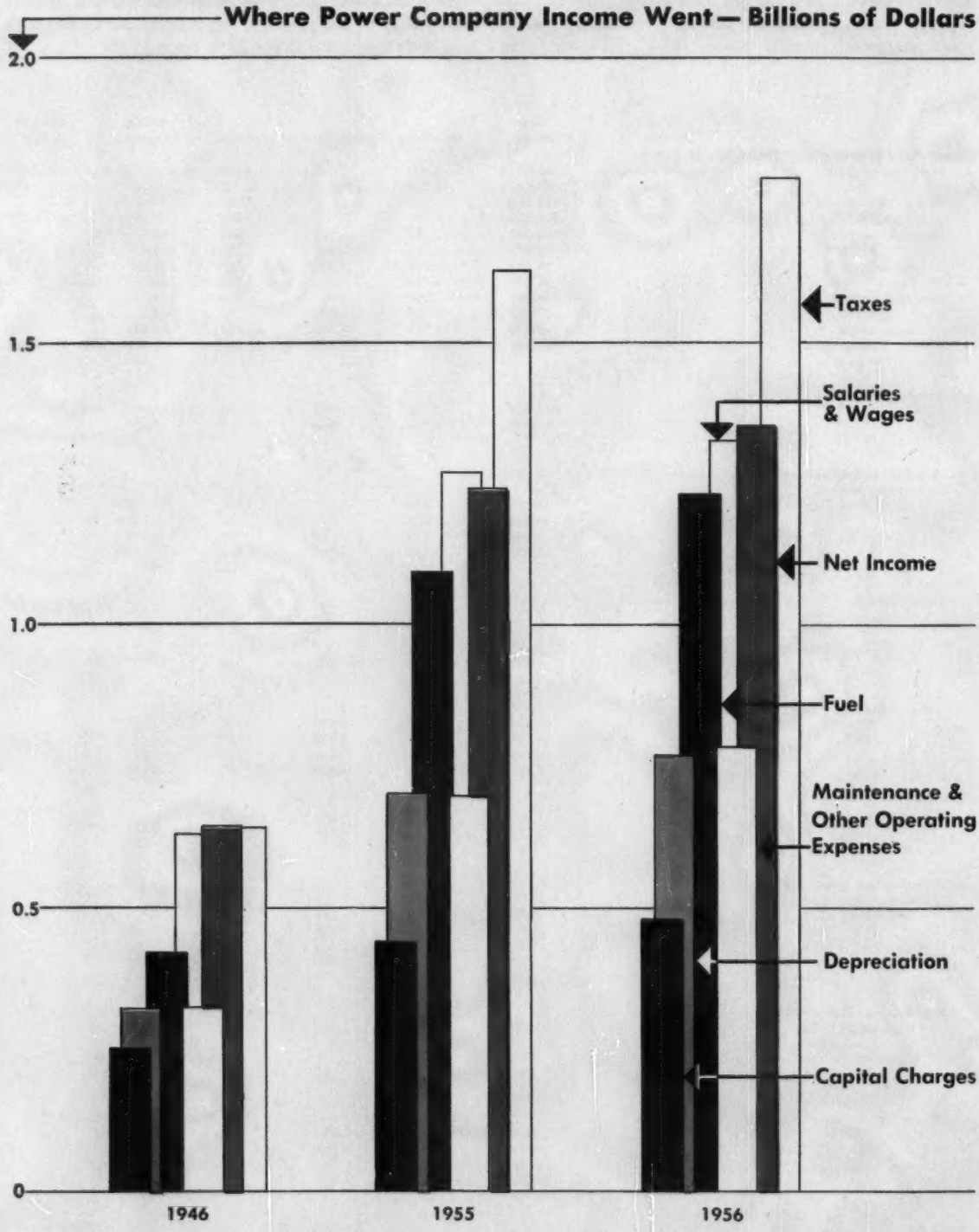
last year hydro absorbed 85% of the amount budgeted for generation, 1957 will see proportionately more spent for fuel plants—24% of generation expenditures.

Fuel plant allocations, although relatively small, have increased steadily since 1954. This year the budget calls for $68 million, a significant increase of 89% over last year's $36 million.

Distribution expenditures of $98 million will be little changed from last year but top transmission's $81-million budget which is down 27% from 1956.

	Total Canada	Manitoba	Saskatchewan	Alberta	British† Columbia	Yukon & N.W.T.
Electric Plant Construction—Thousands of Dollars						
Fuel 1956	35,831	9,302	12,725	4,258	2,100	95
1957	67,940	12,500	20,200	4,240	1,300	75
Hydro 1956	198,086	362	.....	872	19,580	.....
1957	213,325	4,000	.....	1,523	23,087	3,500
Transmission 1956	110,549	2,558	2,881	3,882	24,072	.....
1957	81,125	2,768	5,500	3,289	12,615	.....
Distribution 1956	94,844	4,810	7,213	7,086	12,611	25
1957	98,437	4,720	6,805	7,767	14,035	50
Miscellaneous 1956	24,325	1,297	8,041	603	6,500	.....
1957	23,915	1,250	6,800	1,285	5,483	.....
Total 1956	463,635	18,329	30,860	16,701	64,863	120
1957	484,742	25,238	39,305	18,104	56,520	3,625
Maintenance—Thousands of Dollars						
1956	46,564	2,722	420	5,427	4,400	20
1957	50,403	2,760	503	6,435	5,060	25
Line & Substation Construction—Thousands of Dollars						
Transmission Line						
66 Kv & Up 1956	63,720	178	1,129	1,058	11,696	.....
1957	36,609	458	1,981	1,269	8,947	.....
22–65.9 Kv 1956	7,248	219	1,067	928	1,203	.....
1957	5,652	352	550	560	535	.....
Underground						
Transmission 1956	7,832	.....	.....	.....	5,200	.....
1957	2,937	37	.....	.....	.....	.....
Distribution 1956	5,987	80	50	396	.....	.....
1957	4,955	100	400	510	.....	.....
Primary Distribution Line						
Total 1956	40,636	2,745	5,800	1,901	3,941	20
1957	41,697	2,870	5,288	1,734	4,386	50
Rural 1956	31,786	395	5,250	555	2,641	.....
1957	33,167	300	4,830	582	2,939	.....
Substations 1956	37,541	3,068	815	3,329	8,000	.....
1957	36,162	3,217	1,515	2,613	1,478	.....
Line & Substation Construction						
Transmission Line—Circuit Miles						
66 Kv & Up 1956	1,698	21	171	123	200	.....
1957	1,279	58	226	149	153	.....
22–65.9 Kv 1956	996	62	410	289	45	.....
1957	720	67	250	375	20	.....
Underground—Cable Miles						
Transmission 1956	30	.....	.....	.....	20	.....
1957	15	1	.....	.....	.....	.....
Distribution 1956	272	3	5	14	.....	.....
1957	249	4	23	12	.....	.....
Primary Distribution—Pole Miles						
Total 1956	13,022	2,502	7,655	255	700	5
1957	12,853	2,611	7,108	272	779	10
Rural 1956	10,020	375	7,500	187	469	.....
1957	9,754	325	7,000	194	522	.....
Substation—Thousands of Kva						
1956	5,096	135	134	360	1,270	.....
1957	6,574	168	154	243	1,478	.....

Revenues, Employees, Net Revenue,



and Utility Plant Hit Record Highs

America's independent electric light and power companies made many records in the financial field in 1956. The more important are:

• Gross revenues hit $7.5 billion enabling net income to register a record $1,357 billion, up 8% over 1955.

• Total utility plant totaled $36.5 billion of which $33 billion was electric plant.

Number of electric utility employees reached a record 253,100, up 2,700 from 1955. Hourly earnings averaged $2.23.

All classes of electric revenues showed increases with the largest being in industrial and residential classifications, both going up 9%. This was closely followed by small light and power, up 8%.

Operating expenses were up 9%. Salaries and wages continued to be the second largest expense, taking 17.7¢ out of every electric revenue dollar. Fuel jumped to 16.4¢ from 15.9¢ in 1955. Maintenance and operating expenses held at 10.3¢.

Operating ratio went up slightly from 44.3% in 1955 to 44.4% in 1956.

Taxes continue to take the largest part of the revenue dollar. In 1956 such expense amounted to 23.8¢ of the electric dollar.

Dividends continued to increase. Common amounted to $860 million and preferred, $160 million, making a total of $1,020,000,000, an increase of 7% over 1955.

These independent electric companies were able to transfer $337 million to surplus in 1956, $34 million or 11% over 1955.

Total financing by these companies in 1956 as reported by the Irving Trust Co amounted to $1,483,988,000 of which $965,761,000 was bonds and debentures, $260,492,000 was preferred stock, and $257,735,000 was common stock.

Electric companies received only eight rate increases during 1956, the smallest number since 1950 when 19 were recorded. Of the known increases there were seven grants with a total of $6.7 million annual boost in revenues, a record low since 1948 when figures were first compiled.

Composite Year End Balance Sheet—Millions of Dollars

Class A and B Electric Utility Companies

	1956*	1955	1954	1953
Assets				
Electric Plant and Adjustments	33,000	30,307	28,085	25,597
Other Utility Plant and Adjustments	3,500	3,402	3,162	3,049
Total Utility Plant	36,500	33,709	31,247	28,646
Reserves for Depreciation and Amortization of Utility Plant	7,000	6,406	5,906	5,499
Total Utility Plant Less Reserves	29,500	27,303	25,341	23,147
Investment and Fund Accounts	850	933	1,009	912
Current and Accrued Assets	2,700	2,567	2,438	2,377
Deferred Debits	190	189	187	179
Capital Stock Discount and Expenses	70	66	62	56
Reacquired Securities	26	23	17	27
Total Assets	**33,336**	**31,081**	**29,054**	**26,698**
Liabilities				
Capital Stock				
Preferred	3,725	3,462	3,281	3,084
Common	7,200	6,942	6,644	6,226
Premium on Capital Stock	975	827	710	605
Total Capital Stock	11,900	11,231	10,635	9,915
Long Term Debt				
Bonds	14,850	13,880	12,906	11,630
Other	520	450	416	410
Total Long Term Debt	15,370	14,330	13,322	12,040
Current and Accrued Liabilities	2,500	2,381	2,255	2,228
Reserves (except those deducted above)	250	198	144	93
Deferred Credits	150	138	141	132
Contributions in Aid of Construction	125	109	96	87
Surplus				
Earned	2,701	2,364	2,135	1,868
Capital	340	330	326	335
Total Surplus	3,041	2,694	2,461	2,203
Total Liabilities	**33,336**	**31,081**	**29,054**	**26,698**
Balance Sheet Ratios				
Reserve for Depreciation Percent of Utility Plant	19.2	19.0	18.9	19.2
Current Assets Times Current Liabilities	1.08	1.08	1.08	1.07
Long Term Debt				
Percent of Gross Utility Plant	42.0	42.5	42.6	42.0
Percent of Net Utility Plant	52.0	52.5	52.6	52.0

Source: Federal Power Commission. * 1956 estimated by "Electrical World."

Security Sales by Electric Companies—Thousands of Dollars

	Bonds, Debentures, etc.		Stocks,		Distribution of Security Sales		
	Public Investors	Institutional Investors	Common and Preferred	Total Financing	New Capital	Refunding	Total Issues
1940	660,716	188,976	139,767	989,459	92,376	897,083	989,459
1941	368,712	255,912	116,208	740,832	97,065	643,767	740,832
1942	226,800	99,688	29,766	356,254	92,666	263,588	356,254
1943	329,300	26,850	14,912	371,062	9,921	361,141	371,062
1944	851,743	103,950	62,535	1,018,228	15,587	1,002,641	1,018,228
1945	1,113,603	121,051	127,268	1,361,922	39,699	1,322,253	1,361,922
1946	633,966	64,040	384,441	1,082,447	172,846	909,601	1,082,447
1947	1,039,517	153,159	384,699	1,577,375	567,729	1,009,646	1,577,375
1948	996,641	156,525	297,460	1,450,626	1,314,456	136,170	1,450,626
1949	959,978	192,280	640,953	1,793,211	1,444,826	348,385	1,793,211
1950	838,108	278,389	591,340	1,707,837	1,300,040	407,797	1,707,837
1951	778,308	110,696	552,943	1,441,947	1,432,257	9,690	1,441,947
1952	929,167	145,860	630,652	1,705,679	1,693,514	12,165	1,705,679
1953	973,075	217,022	766,594	1,956,691	1,938,815	17,876	1,956,691
1954	1,379,885	184,063	784,469	2,348,417	1,781,154	587,263	2,348,417
1955	871,173	130,298	538,927	1,540,398	1,409,415	130,983	1,540,398
1956	911,145	54,616	518,227	1,483,988	1,479,987	4,001	1,483,988

Source: Irving Trust Co

Power Companies Income Statement—Millions of Dollars

	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956*
Total Electric Revenue	3,012	3,127	3,480	3,886	4,113	4,510	5,005	5,426	5,940	6,310	6,933	7,535
Operating Expenses	1,259	1,385	1,701	2,019	2,030	2,158	2,400	2,577	2,801	2,875	3,074	3,349
Depreciation	322	324	339	364	389	438	475	513	565	634	705	770
Total Expenses	1,581	1,709	2,040	2,383	2,419	2,596	2,875	3,090	3,366	3,509	3,779	4,119
Electric Operating Income before Taxes	1,431	1,418	1,440	1,503	1,694	1,914	2,130	2,336	2,574	2,801	3,154	3,416
Taxes	652	644	664	712	794	948	1,150	1,224	1,339†	1,437†	1,641†	1,790†
Electric Operating Income after Taxes	779	774	776	791	900	966	980	1,112	1,235	1,364	1,513	1,626
Other Income [1]	126	130	125	118	132	147	154	166	149	176	187	216
Gross Corporate Income	905	904	901	909	1,032	1,113	1,134	1,278	1,384	1,540	1,700	1,842
Capital Charges [2]	360	258	245	243	267	282	311	322	343	389	443	485
Net Income	545	646	656	666	765	831	823	956	1,041	1,151	1,257	1,357
Dividends	415	466	500	499	566	626	658	732	788	866	953	1,020
Surplus	130	180	156	167	199	205	165	224	253	285	304	337

Source: Federal Power Commission and Edison Electric Institute. *Estimated. [1] Includes revenues of gas, water, and steam departments and interest on securities held. [2] Includes amortization and interest on long term debt. † Includes Federal Income Tax deferment arising from amortization of emergency facilities.

Distribution of the Electric Revenue Dollar—Percent

	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956*
Fuel	12.7	13.7	17.2	20.0	17.2	16.8	17.2	16.9	17.1	15.6	15.9	16.4
Salaries and Wages	18.1	20.2	21.2	21.2	21.1	20.7	20.5	20.0	19.6	19.4	18.1	17.7
Maintenance and Other Operating Expenses	11.0	10.5	10.5	10.8	11.1	10.4	10.3	10.5	10.5	10.5	10.3	10.3
Operating Ratio	41.8	44.4	48.9	52.0	49.4	47.9	48.0	47.4	47.2	45.5	44.3	44.4
Depreciation	10.7	10.4	9.7	9.4	9.5	9.7	9.5	9.5	9.5	10.0	10.2	10.2
Taxes	21.6	20.6	19.1	18.3	19.3	21.0	23.0	22.6	22.5	22.8	23.7	23.8
Electric Operating Income Before Taxes	47.5	45.4	41.4	38.7	41.2	42.4	42.6	43.1	43.3	44.4	45.5	45.4
Electric Operating Income After Taxes	25.9	24.8	22.3	20.4	21.9	21.4	19.6	20.5	20.8	21.6	21.8	21.6

Source: Federal Power Commission and Edison Electric Institute. * Estimated by Electrical World

Electric Rate Increases

	GRANTED				PENDING		
		Known Increases				Known Pending	
	Grants	Grants	Dollars	As of Dec. 31	Applications	Applications	Dollars
1948	81	45	39,000,000	1948	18	11	22,000,000
1949	74	44	35,000,000	1949	7	5	16,000,000
1950	19	10	14,000,000	1950	21	14	20,200,000
1951	44	27	32,900,000	1951	44	32	75,700,000
1952	78	57	76,700,000	1952	36	21	44,400,000
1953	43	27	21,000,000	1953	27	22	62,700,000
1954	31	21	54,200,000	1954	23	16	37,600,000
1955	29	19	25,500,000	1955	8	8	10,500,000
1956*	8	7	6,700,000	1956*	12	11	26,600,000

*Preliminary.

Average Wages

	Electric Utility Employees				All Manufacturing Employees			
	Hourly Earnings	Weekly Earnings	Weekly Hours	Employees (thousands)	Hourly Earnings	Weekly Earnings	Weekly Hours	Employees (thousands)
1949	$1.56	$64.91	41.6	236.4	$1.40	$54.92	39.2	14,178
1950	1.63	67.81	41.6	238.9	1.47	59.33	40.4	14,967
1951	1.74	72.91	41.9	240.4	1.59	64.71	40.7	16,104
1952	1.84	76.18	41.4	244.0	1.67	67.97	40.7	16,334
1953	1.97	81.56	41.4	248.2	1.77	71.69	40.5	17,238
1954	2.05	84.67	41.3	249.0	1.81	71.86	39.7	15,995
1955	2.14	88.17	41.2	250.4	1.88	76.52	40.7	16,557
1956*	2.23	92.81	41.6	253.1	1.96	79.10	40.3	16,792

Source: Bureau of Labor Statistics. * Estimated

REA—FINANCED SYSTEMS

Co-ops Up Sales 15%, Revenues 11%

REA-financed power systems sold almost 22 billion kwhr in 1956 as compared with 19.2 billion kwhr in 1955. While this showed a 15% increase, revenues rose 11%.

For all borrowers, operating revenues totaled $500.9 million in 1956 as against $449.6 million in 1955. Revenue per kwhr amounted to 2.28¢ in 1956 versus 2.37¢ in the previous year.

Average revenue for residential consumers, including farm and nonfarm, dropped to a new low of 2.86¢ per kwhr in 1956 as compared with 2.98¢ in 1955, and 3.09¢ in 1954. Average residential bill amounted to $92.26. This compared with $86.40 in 1955.

Average annual kwhrs per residential consumer hit a record 3,228 kwhrs, 324 more than 1955.

Cost of input energy for these REA-financed power systems amounted to 6.94 mills per kwhr in 1956. In 1955 it amounted to 7.11 mills.

At Dec. 31, 1956, there were 1,028 systems in operation, serving a total of 4,357,000 customers.

Statistics of REA-Financed Systems

	1954	1955	1956
CUMULATIVE YEAR-END DATA			
Total Loans Approved	$2,946,228,477	$3,125,067,511	$3,343,100,000
Distribution Lines	$2,379,190,834	$2,508,160,694	$2,647,800,000
Generation and Transmission	$ 543,744,565	$ 589,327,426	$ 663,500,000
Consumer Facilities	$ 23,293,078	$ 27,579,391	$ 31,800,000
Funds Advanced	$2,524,105,716	$2,677,398,928	$2,838,800,000
Systems in Operation	1,024	1,026	1,028
Miles of Line in Operation	1,332,937	1,361,605	1,384,000
Consumers Served [2]	4,174,346	4,251,250	4,357,000
Systems Generating Power During Year	56	78	75
Generating Plants—kw	822,325	851,085	866,000
ANNUAL DATA[1]			
Energy Generated—kwhr	2,720,907,119	3,254,591,881	3,608,000,000
Energy Purchased—kwhr [3]	16,129,367,014	18,457,305,486	21,126,000,000
Total System Input—kwhr [3]	18,850,274,133	21,711,897,367	24,734,000,000
Energy Sold—kwhr [3]	16,508,177,005	19,200,476,326	21,995,000,000
Operating Revenues [3]	$ 408,144,564	$ 449,625,847	$ 500,900,000
Operating Deductions Totals	$ 326,868,653	$ 353,400,516	$ 389,400,000
Cost of Power [4]	$ 138,236,950	$ 154,341,219	$ 171,600,000
Distribution Expenses—Operations	$ 30,426,367	$ 31,832,065	$ 35,300,000
Distribution Expenses—Maintenance	$ 16,395,166	$ 16,231,249	$ 17,800,000
Consumers Accounting & Collecting	$ 14,511,858	$ 15,311,515	$ 16,800,000
Administration & General Expenses	$ 34,319,823	$ 37,157,365	$ 40,200,000
Other Operating Expenses	$ 4,639,065	$ 5,125,713	$ 6,200,000
Depreciation	$ 75,776,005	$ 79,597,403	$ 85,500,000
Amortization of Intangibles	$ 1,149,030	$ 1,086,951	$ 1,900,000
Taxes	$ 11,414,389	$ 12,717,036	$ 14,100,000
Utility Operating Margin	$ 81,275,911	$ 96,225,331	$ 111,500,000
Non-Operating Margin	$ 3,280,170	$ 5,101,464	$ 5,700,000
Interest on Long Term Debt	$ 40,397,061	$ 42,339,282	$ 43,900,000
Interest Charged to Construction Cr	$ 344,075	$ 360,642	$ 600,000
Other Deductions	$ 537,312	$ 511,905	$ 600,000
Net Margin	$ 43,965,783	$ 58,836,250	$ 73,300,000
PAYMENTS TO GOVERNMENT—CUMULATIVE DATA			
Interest Due	$ 192,699,770	$ 227,389,765	$ 265,600,000
Interest Paid	$ 192,599,755	$ 227,294,786	$ 265,300,000
Principal Due	$ 297,905,511	$ 359,041,008	$ 428,200,000
Principal Paid	$ 376,238,237	$ 452,524,896	$ 533,000,000
Overdue Amounts—More than 30 days	$ 307,340	$ 417,183	$ 234,000*
a. Interest	$ 55,083	$ 28,617	$ 26,000*
b. Principal	$ 252,257	$ 388,566	$ 208,000*
Advance Payments of Principal	$ 78,647,457	$ 91,231,945	$ 102,100,000

Source: Monthly Operating Reports of Rural Electrification Administration borrowers and records of the Rural Electrification Administration.

[1] Based on nine months actual data 1956 and one to three months estimated. *Preliminary

[2] Formerly called "Consumers Connected." The change is a result of a revised definition of a consumer as reported by REA borrowers, effective January 1, 1955. Figures are on the former basis for 1954; and on the new basis for 1955 and 1956. The change resulted in a downward adjustment in the national total of about 60,000, chiefly through elimination of idle services.

[3] Includes energy sales and revenues of power sold by one REA borrower to another.

[4] Cost of Power includes cost of purchased power and prime costs involved in the production and transmission of generated energy.

CUSTOMERS

1.44 Million New Customers

	Residential			Rural*			Small Light & Power		
	Customers	% Total	Annual Change	Customers	% Total	Annual Change	Customers	% Total	Annual Change
1940..	24,951,906	82.6	986,871 (4.1%)	685,812	2.3	51,563 (8.1%)	4,260,255	14.1	45,001 (1.1%)
1941..	26,025,513	82.3	1,073,607 (4.3%)	986,719	3.1	300,907 (43.9%)	4,299,976	13.6	39,721 (0.9%)
1942..	26,620,456	82.6	594,943 (2.3%)	1,095,512	3.4	108,793 (11.0%)	4,219,457	13.1	−80,519 (1.9%)
1943..	26,872,639	82.9	252,183 (0.9%)	1,088,698	3.4	−6,814 (0.6%)	4,168,245	12.8	−51,212 (1.2%)
1944..	27,371,260	82.8	498,621 (1.9%)	1,144,241	3.5	55,543 (5.1%)	4,263,395	12.9	95,150 (2.3%)
1945..	28,116,998	82.6	745,738 (2.7%)	1,234,441	3.6	90,200 (7.9%)	4,398,184	12.9	134,789 (3.2%)
1946..	29,769,107	82.3	1,652,109 (5.9%)	1,381,291	3.8	146,850 (11.9%)	4,692,850	13.0	294,666 (6.7%)
1947..	31,621,959	82.2	1,852,852 (6.2%)	1,522,136	4.0	140,845 (10.2%)	4,960,895	12.9	268,045 (5.7%)
1948..	33,549,396	82.4	1,927,437 (6.1%)	1,694,579	4.1	172,443 (11.3%)	5,131,730	12.6	170,835 (3.4%)
1949..	35,375,366	82.6	1,825,970 (5.4%)	1,804,415	4.2	109,836 (6.5%)	5,290,768	12.3	159,038 (3.1%)
1950..	37,532,549	83.4	2,157,183 (6.1%)	1,596,146	3.5	−208,269 (11.5%)	5,466,181	12.2	175,413 (3.3%)
1951..	39,224,621	83.8	1,692,072 (4.5%)	1,658,728	3.5	62,582 (3.9%)	5,528,117	11.8	61,936 (1.1%)
1952..	40,738,718	84.1	1,514,097 (3.9%)	1,663,201	3.4	4,473 (0.3%)	5,634,130	11.6	106,013 (1.9%)
1953..	41,981,633	84.1	1,242,915 (3.1%)	1,621,810	3.3	−41,391 (2.5%)	5,863,210	11.7	229,080 (4.1%)
1954..	43,139,998	84.2	1,158,365 (2.8%)	1,637,535	3.2	15,725 (1.0%)	5,991,586	11.7	128,376 (2.2%)
1955..	44,408,690	84.5	1,268,692 (2.9%)	1,648,398	3.1	10,863 (0.7%)	6,042,309	11.5	50,723 (0.8%)
1956†.	45,710,000	84.6	1,301,310 (2.9%)	1,690,000	3.1	41,602 (2.5%)	6,125,000	11.3	82,691 (1.4%)

Source: Edison Electric Institute. *Customers served under distinctly rural rates. ‡Estimated.

SALES

Energy Sales Jump 10%

(Millions of kwhr)

	Residential			Rural*			Small Light & Power		
	Sales	% Total	Annual Change	Sales	% Total	Annual Change	Sales	% Total	Annual Change
1940..	23,317	19.7	2,233 (10.6%)	1,991	1.7	110 (5.8%)	22,373	18.8	1,651 (8.0%)
1941..	25,124	17.9	1,807 (7.7%)	2,352	1.7	361 (18.1%)	24,628	17.6	2,255 (10.1%)
1942..	26,937	16.9	1,813 (7.2%)	2,890	1.8	538 (22.9%)	27,233	17.1	2,605 (10.6%)
1943..	28,621	15.4	1,684 (6.3%)	2,996	1.6	106 (3.7%)	28,192	15.2	959 (3.5%)
1944..	31,266	15.7	2,645 (9.2%)	3,373	1.7	377 (12.6%)	29,837	15.1	1,645 (5.8%)
1945..	34,184	17.7	2,918 (9.3%)	3,669	1.9	296 (8.8%)	30,438	15.7	601 (2.0%)
1946..	38,571	20.2	4,387 (12.8%)	4,431	2.3	762 (20.8%)	33,016	17.3	2,578 (8.5%)
1947..	44,171	20.3	5,600 (14.5%)	5,551	2.5	1,120 (25.3%)	38,379	17.6	5,363 (16.2%)
1948..	50,978	21.2	6,807 (15.4%)	6,327	2.6	776 (14.0%)	43,193	17.9	4,814 (12.5%)
1949..	58,139	23.4	7,161 (14.0%)	7,384	3.0	1,057 (16.7%)	46,262	18.6	3,069 (7.1%)
1950..	67,030	23.9	8,891 (15.3%)	7,400	2.6	16 (0.2%)	50,446	18.0	4,184 (9.0%)
1951..	77,024	24.2	9,994 (14.9%)	8,479	2.7	1,079 (14.6%)	57,278	18.0	6,832 (13.5%)
1952..	86,780	25.3	9,756 (12.7%)	8,536	2.5	57 (0.7%)	62,080	18.1	4,802 (8.4%)
1953..	97,063	25.3	10,283 (11.8%)	9,613	2.5	1,077 (12.6%)	69,208	18.0	7,128 (11.5%)
1954..	108,465	26.4	11,402 (11.7%)	10,176	2.5	563 (5.9%)	73,373	17.9	4,165 (6.0%)
1955..	120,524	25.1	12,059 (11.1%)	10,751	2.2	575 (5.7%)	80,759	16.8	7,386 (10.1%)
1956‡.	133,800	25.3	13,276 (11.0%)	11,200	2.1	449 (4.2%)	88,400	16.7	7,641 (9.5%)

Source: Edison Electric Institute. *Sales on distinct rural rates. ‡Estimated.

Push Total to 54 Million

	Large Light & Power			Other Classifications			Total	
	Customers	% Total	Annual Change	Customers	% Total	Annual Change	Customers	Annual Change
1940..	177,905	0.6	−6,394 (3.5%)	115,123	0.4	8,654 (8.1%)	30,191,001	1,085,695 (3.7%)
1941..	172,677	0.6	−5,228 (2.9%)	122,486	0.4	7,363 (6.4%)	31,607,371	1,416,370 (4.7%)
1942..	149,928	0.5	−22,749 (13.2%)	125,087	0.4	2,601 (2.1%)	32,210,440	603,069 (1.9%)
1943..	146,593	0.5	−3,335 (2.2%)	120,125	0.4	−4,962 (4.0%)	32,396,300	185,860 (0.6%
1944..	151,652	0.4	5,059 (3.5%)	117,844	0.4	−2,281 (1.9%)	33,048,392	652,092 (2.0%)
1945..	162,338	0.5	10,686 (7.0%)	119,112	0.4	1,268 (1.1%)	34,031,073	982,681 (3.0%)
1946..	174,662	0.5	12,324 (7.6%)	122,381	0.3	3,269 (2.7%)	36,140,291	2,109,218 (6.2%)
1947..	191,363	0.5	16,701 (9.6%)	135,597	0.4	13,216 (10.8%)	38,431,950	2,291,659 (6.3%)
1948..	204,230	0.5	12,867 (6.7%)	142,053	0.3	6,456 (4.8%)	40,721,988	2,290,038 (6.0%)
1949..	232,125	0.5	27,895 (13.7%)	148,107	0.3	6,054 (4.3%)	42,850,781	2,128,793 (5.2%)
1950..	234,728	0.5	2,603 (1.1%)	156,690	0.3	8,583 (5.8%)	44,986,294	2,135,513 (5.0%)
1951..	247,532	0.5	12,804 (5.5%)	162,881	0.3	6,191 (4.0%)	46,821,879	1,835,585 (4.1%)
1952..	256,294	0.5	8,762 (3.5%)	158,228	0.3	−4,653 (2.9%)	48,450,571	1,628,692 (3.5%)
1953..	271,947	0.5	15,653 (6.1%)	160,465	0.3	2,237 (1.4%)	49,899,065	1,448,494 (3.0%)
1954..	280,819	0.5	8,872 (3.3%)	164,621	0.3	4,156 (2.6%)	51,214,559	1,315,494 (2.6%)
1955..	287,788	0.5	6,969 (2.5%)	171,416	0.3	6,795 (4.1%)	52,558,601	1,344,042 (2.6%)
1956‡.	300,000	0.6	12,212 (4.2%)	175,000	0.3	3,584 (2.1%)	54,000,000	1,441,399 (2.7%)

to Hit 529 Billion Kwhr

(Millions of kwhr)

	Large Light & Power			Other Classifications			Total	
	Sales	% Total	Annual Change	Sales	% Total	Annual Change	Sales	Annual Change
1940..	59,557	50.2	8,449 (16.5%)	11,405	9.6	433 (3.9%)	118,643	12,876 (12.2%)
1941..	76,061	54.3	16,504 (27.7%)	11,895	8.5	490 (4.3%)	140,060	21,417 (18.1%)
1942..	88,378	55.4	12,317 (16.2%)	13,969	8.8	2,074 (17.4%)	159,407	19,347 (13.8%)
1943..	106,657	57.4	18,279 (20.7%)	19,423	10.4	5,454 (3.9%)	185,889	26,482 (16.6%)
1944..	115,187	58.1	8,530 (8.0%)	18,497	9.3	−926 (4.8%)	198,160	12,271 (6.6%)
1945..	107,490	55.5	−7,697 (6.7%)	17,777	9.2	−720 (3.9%)	193,558	−4,602 (2.3%)
1946..	98,885	51.8	−8,605 (8.0%)	15,892	8.3	−1,885 (10.6%)	190,795	−2,763 (1.4%)
1947..	113,523	52.2	14,638 (14.8%)	15,957	7.3	65 (0.4%)	217,581	26,786 (14.0%)
1948..	124,088	51.6	10,565 (9.3%)	16,154	6.7	197 (1.2%)	240,740	23,159 (10.6%)
1949..	120,766	48.6	−3,322 (2.7%)	15,991	6.4	−163 (1.0%)	248,542	7,802 (3.2%)
1950..	139,065	49.5	18,299 (15.2%)	16,598	5.9	607 (3.8%)	280,539	31,997 (12.9%)
1951..	157,827	49.6	18,762 (13.5%)	17,560	5.5	962 (5.8%)	318,168	37,629 (13.4%)
1952..	167,358	48.9	9,531 (6.0%)	17,770	5.2	210 (1.2%)	342,524	24,356 (7.7%)
1953..	190,010	49.5	22,652 (13.5%)	18,350	4.8	580 (3.3%)	384,244	41,720 (12.2%)
1954..	200,155	48.7	10,145 (5.3%)	18,735	4.6	385 (2.1%)	410,904	26,660 (6.9%)
1955..	249,206	51.8	49,051 (24.5%)	19,681	4.1	946 (5.0%)	480,921	70,017 (17.0%)
1956‡.	274,400	51.9	25,194 (10.1%)	21,200	4.0	1,519 (7.7%)	529,000	48,079 (10.0%)

REVENUE

8.7% Increase Sends Industry

(Thousands of Dollars)

	Residential			Rural*			Small Light & Power		
	Revenue	% Total	Annual Change	Revenue	% Total	Annual Change	Revenue	% Total	Annual Change
1940..	895,951	36.7	52,793 (6.3%)	49,473	2.0	3,989 (8.8%)	689,253	28.2	28,570 (4.3%)
1941..	938,229	35.2	42,278 (4.7%)	64,396	2.4	14,923 (30.2%)	725,117	27.2	35,864 (5.2%)
1942..	990,185	34.7	51,956 (5.5%)	75,027	2.6	10,631 (16.5%)	767,279	26.9	42,162 (5.8%)
1943..	1,029,260	33.4	39,075 (3.9%)	76,617	2.5	1,590 (2.1%)	773,678	25.2	6,399 (0.8%)
1944..	1,097,726	33.5	68,466 (6.7%)	82,842	2.5	6,225 (8.1%)	817,355	24.9	43,677 (5.6%)
1945..	1,167,356	34.9	69,630 (6.3%)	90,345	2.7	7,503 (9.1%)	850,213	25.4	32,858 (4.0%)
1946..	1,240,577	35.9	73,221 (6.3%)	104,876	3.0	14,531 (16.1%)	924,775	26.7	74,562 (8.8%)
1947..	1,366,498	35.5	125,921 (10.2%)	123,749	3.2	18,873 (18.0%)	1,031,335	26.8	106,560 (11.5%)
1948..	1,532,664	35.5	166,166 (12.2%)	140,648	3.3	16,899 (13.7%)	1,152,783	26.7	121,448 (11.8%)
1949..	1,716,533	37.2	183,869 (12.0%)	160,855	3.5	20,207 (14.4%)	1,228,726	26.6	75,943 (6.6%)
1950..	1,931,696	38.0	215,163 (12.5%)	157,611	3.1	−3,244 (2.0%)	1,333,755	26.2	105,029 (8.5%)
1951..	2,165,010	38.3	233,314 (12.1%)	175,431	3.1	17,820 (11.3%)	1,462,262	25.9	128,507 (9.6%)
1952..	2,400,889	39.1	235,879 (10.9%)	184,479	3.0	9,048 (5.2%)	1,584,219	25.8	121,957 (8.3%)
1953..	2,659,303	39.1	258,414 (10.7%)	201,691	3.0	17,212 (9.3%)	1,747,572	25.7	163,353 (10.3%)
1954..	2,920,196	40.1	260,893 (9.8%)	216,391	3.0	14,700 (7.3%)	1,846,634	25.4	99,062 (5.7%)
1955..	3,186,651	39.7	266,455 (9.1%)	228,815	2.9	12,424 (5.7%)	1,993,099	24.9	146,465 (7.9%)
1956‡.	3,472,000	39.8	285,349 (9.0%)	241,000	2.8	12,185 (5.3%)	2,161,000	24.8	167,901 (8.4%)

Source: Edison Electric Institute. *Revenue from sales under distinctly rural rates. ‡Estimated.

AVERAGE USE

Residential Bill for 1956

	Residential				Small Light	
	Average Use		Average Bill		Average Use	
	Kwhr	Change	per Kwhr	Annual	Kwhr	Change
1940.....	952	55 (6.1%)	3.84¢	$36.56	5,280	312 (6.3%)
1941.....	986	34 (3.6%)	3.73¢	$36.78	5,754	474 (9.0%)
1942.....	1,022	36 (3.7%)	3.67¢	$37.51	6,354	600 (10.4%)
1943.....	1,070	48 (4.7%)	3.60¢	$38.52	6,722	368 (5.8%)
1944.....	1,151	81 (7.6%)	3.51¢	$40.40	7,080	358 (5.3%)
1945.....	1,229	78 (6.8%)	3.41¢	$41.97	7,062	−18 (0.3%)
1946.....	1,329	100 (8.1%)	3.22¢	$42.79	7,224	162 (2.3%)
1947.....	1,438	109 (8.2%)	3.09¢	$44.43	7,915	691 (9.6%)
1948.....	1,563	125 (8.7%)	3.01¢	$47.05	8,535	620 (7.8%)
1949.....	1,684	121 (7.7%)	2.95¢	$49.68	8,871	336 (3.9%)
1950.....	1,830	146 (8.7%)	2.88¢	$52.70	9,320	449 (5.1%)
1951.....	2,004	174 (9.5%)	2.81¢	$56.31	10,432	1,112 (11.9%)
1952.....	2,169	165 (8.2%)	2.77¢	$60.08	11,106	674 (6.5%)
1953.....	2,346	177 (8.2%)	2.74¢	$64.28	12,007	901 (8.1%)
1954.....	2,549	203 (8.7%)	2.69¢	$68.57	12,353	346 (2.9%)
1955.....	2,751	202 (7.9%)	2.64¢	$72.63	13,422	1,069 (8.7%)
1956*.....	2,980	229 (8.3%)	2.59¢	$77.18	14,490	1,068 (8.0%)

Source: Edison Electric Institute. *Estimated.

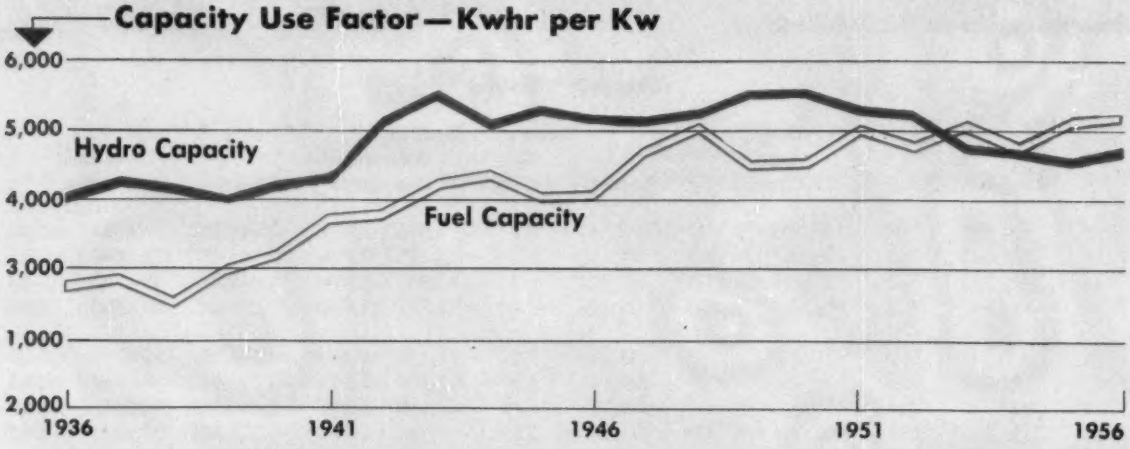
Revenues Up to $8.7 Billion

(Thousands of Dollars)

	Large Light & Power			Other Classifications			Total	
	Revenue	% Total	Annual Change	Revenue	% Total	Annual Change	Revenue	Annual Change
1940..	631,428	25.9	58,769 (10.3%)	174,112	7.1	6,513 (3.9%)	2,440,217	150,634 (6.6%)
1941..	758,083	28.5	126,655 (20.1%)	179,232	6.7	5,120 (2.9%)	2,665,057	224,840 (9.2%)
1942..	828,318	29.0	70,235 (9.3%)	195,034	6.8	15,802 (8.8%)	2,855,843	190,786 (7.2%)
1943..	964,192	31.3	135,874 (16.4%)	233,696	7.6	38,862 (19.9%)	3,077,643	221,800 (7.8%)
1944..	1,043,392	31.8	79,200 (8.2%)	235,436	7.2	1,450 (6.2%)	3,276,751	199,108 (6.5%)
1945..	1,001,957	30.0	−41,435 (4.0%)	231,647	6.9	− 3,789 (1.6%)	3,341,518	64,767 (2.0%)
1946..	969,349	28.0	−32,608 (3.3%)	219,983	6.4	−11,664 (5.0%)	3,459,560	118,042 (3.5%)
1947..	1,106,555	28.7	137,206 (14.1%)	224,628	5.8	4,645 (2.1%)	3,852,765	393,205 (11.4%)
1948..	1,250,684	29.0	144,129 (13.0%)	236,534	5.5	11,906 (5.3%)	4,313,313	460,548 (12.0%)
1949..	1,262,698	27.4	12,014 (1.0%)	245,257	5.3	8,723 (3.7%)	4,614,069	300,756 (7.0%)
1950..	1,404,980	27.6	142,282 (11.3%)	258,423	5.1	13,166 (5.4%)	5,086,465	472,396 (10.2%)
1951..	1,571,932	27.8	166,952 (11.9%)	273,037	4.8	14,614 (5.7%)	5,647,672	561,207 (11.0%)
1952..	1,684,073	27.4	112,141 (7.1%)	283,612	4.6	10,575 (3.9%)	6,137,272	489,600 (8.7%)
1953..	1,883,640	27.7	199,567 (11.9%)	301,454	4.4	17,842 (6.3%)	6,793,660	656,388 (10.7%)
1954..	1,977,283	27.2	93,643 (5.0%)	316,763	4.4	15,309 (5.1%)	7,277,267	483,607 (7.1%)
1955..	2,275,727	28.4	298,444 (15.1%)	336,147	4.2	19,384 (6.1%)	8,020,439	743,172 (10.2%)
1956‡.	2,486,000	28.5	210,273 (9.2%)	360,000	4.1	23,853 (7.1%)	8,720,000	699,561 (8.7%)

Averaged $77.18 for 2,980 Kwhr

and Power Average Bill per Kwhr	Annual	Total Ultimate Customers Average Use Kwhr	Change	Average Bill per Kwhr	Annual	
3.08¢	$163	3,998	296 (8.0%)	2.06¢	$82.35	1940
2.94¢	$169	4,535	537 (13.4%)	1.90¢	$86.17	1941
2.82¢	$179	4,980	445 (9.8%)	1.79¢	$98.14	1942
2.74¢	$184	5,753	773 (15.5%)	1.66¢	$95.50	1943
2.74¢	$194	6,047	294 (5.1%)	1.65¢	$99.78	1944
2.79¢	$197	5,762	−285 (4.7%)	1.73¢	$99.68	1945
2.80¢	$202	5,422	−340 (5.9%)	1.81¢	$98.14	1946
2.69¢	$213	5,828	406 (7.5%)	1.77¢	$103.16	1947
2.67¢	$228	6,073	245 (4.2%)	1.79¢	$108.71	1948
2.66¢	$236	5,937	−136 (2.2%)	1.86¢	$110.43	1949
2.64¢	$246	6,377	440 (7.4%)	1.81¢	$115.42	1950
2.55¢	$266	6,922	545 (8.5%)	1.78¢	$123.21	1951
2.55¢	$283	7,183	261 (3.8%)	1.79¢	$128.58	1952
2.53¢	$304	7,815	632 (8.8%)	1.77¢	$138.33	1953
2.52¢	$311	8,127	312 (4.0%)	1.77¢	$143.85	1954
2.47¢	$332	9,265	1,138 (14.0%)	1.67¢	$154.73	1955
2.44¢	$354	9,923	658 (7.1%)	1.62¢	$160.75	.....1956*



Coal Rate Down to 0.94 Lb

The coal rate of fuel plants in 1956 continued the gradual decline that has paced the steady improvement in efficiency of generation. This year the coal rate dropped to 0.94 lb per kwhr from the 1955 level of 0.95 to record an improvement of 1.1%. In the two years since 1954 there has been a 5% improvement, and in the last decade coal rate has improved 28%.

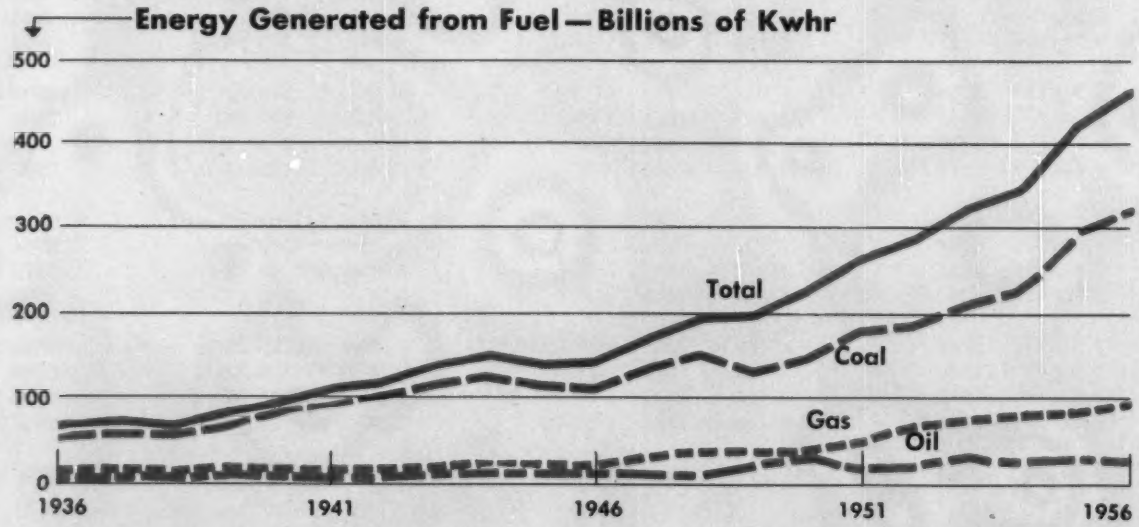
During 1956 71% of the energy produced thermally, was generated by coal, an increase of 1½ percentage points over the 1955 figure of 69.5%. Gas and oil produced 21.5% and 7.5% respectively, but there was little significant change in the division of generation between these two fuels compared with 1955.

Coal consumption in 1956 was 158 million tons—14 million tons more than in 1955. This represents an increase of 9.7% over 1955's consumption of 144 million tons.

Use of gas increased 5.6% this year aggregating 1,218 billion cu ft an increase of 65 billion cu ft over 1955's 1,153 billion. Oil, on the other hand, decreased 3% during the year. This represents a reversal of conditions that prevailed in 1955 when consumption of gas declined and consumption of oil increased.

The use of fuel capacity hit a record high of 5,222 hours in 1956 out of the 8,784 hours possible. This compares with 5,141 hours in 1955. Hours' use of hydro was 4,776 up almost 2% compared with last year but was short of a record.

The all-time high for hydro use was set in 1950, 5,589 hours—813 hours more than this past year.



Production, Capacity, Average Use

	Production Millions of Kwhr			Year End Capacity Thousands of Kw			Kwhr per Kw of Average Capacity		
	Fuel	Hydro	Total	Fuel	Hydro	Total	Fuel	Hydro	Total
1940	94,516	47,321	141,837	28,703	11,224	39,927	3,342	4,258	3,600
1941	113,925	50,863	164,788	30,588	11,817	42,405	3,843	4,415	4,003
1942	122,109	63,871	185,979	32,211	12,842	45,053	3,889	5,180	4,253
1943	144,127	73,632	217,759	34,067	13,884	47,951	4,349	5,510	4,683
1944	154,244	73,945	228,189	34,603	14,586	49,189	4,492	5,195	4,698
1945	142,516	79,970	222,486	35,199	14,912	50,111	4,078	5,422	4,481
1946	144,772	78,406	223,178	35,468	14,849	50,317	4,097	5,269	4,445
1947	177,313	78,426	255,739	37,351	14,971	52,322	4,870	5,260	4,983
1948	200,228	82,470	282,698	40,908	15,652	56,560	5,052	5,386	5,193
1949	201,351	89,748	291,100	46,446	16,654	63,100	4,610	5,561	4,865
1950	233,203	95,938	329,141	51,244	17,675	68,919	4,774	5,589	4,986
1951	270,922	99,751	370,673	56,907	18,868	75,775	5,010	5,460	5,123
1952	294,121	105,102	399,224	61,807	20,419	82,226	4,955	5,350	5,054
1953	337,432	105,233	442,665	69,457	22,045	91,502	5,141	4,957	5,096
1954	364,617	107,069	471,686	79,382	23,211	102,592	4,899	4,732	4,860
1955	434,063	112,975	547,038	89,468	25,004	114,472	5,141	4,686	5,040
1956*	479,605	121,835	601,441	94,231	26,019	120,250	5,222	4,776	5,125

Source: Federal Power Commission. *Estimated. 1945 and after excludes former Mining and Manufacturing and Railroad and Railway classifications.

Consumption of Coal, Oil and Gas

	Energy Generated From Coal, Oil, and Gas				Coal, Oil, and Gas Consumed				Coal Rate
	Coal Billions of Kwhr	Oil Billions of Kwhr	Gas Billions of Kwhr	Total Billions of Kwhr	Coal Millions of Tons	Oil Millions of Bbls	Gas Billions of Cu Ft	Coal and Equivalent of Oil and Gas Millions of Tons	Pounds per Kwhr
1940	76.8	6.2	10.9	94.0	51.47	16.33	180.10	62.94	1.34
1941	93.8	7.5	12.0	113.3	62.67	20.08	201.76	75.70	1.34
1942	101.9	5.6	14.1	121.6	66.26	15.24	235.21	79.08	1.30
1943	119.2	6.8	17.8	143.8	77.30	17.99	301.94	93.27	1.30
1944	124.1	8.1	21.6	153.9	80.08	20.86	358.78	99.25	1.29
1945	114.8	7.8	19.7	142.3	74.72	20.23	326.21	92.64	1.30
1946	111.7	14.1	18.8	144.6	72.20	36.32	306.94	93.47	1.29
1947	137.0	16.9	23.1	177.0	89.53	45.31	373.05	115.67	1.31
1948	152.9	16.8	30.1	199.8	99.59	42.64	478.10	130.12	1.30
1949	135.5	28.5	37.0	201.0	83.96	66.30	550.12	124.57	1.24
1950	154.5	33.7	44.6	232.8	91.87	75.42	628.92	138.42	1.19
1951	185.2	28.7	56.6	270.5	105.77	63.94	763.90	154.50	1.14
1952	195.4	29.7	68.5	293.6	107.07	67.22	910.12	160.87	1.10
1953	218.9	38.4	79.8	337.1	115.90	82.24	1,034.27	178.49	1.06
1954	239.1	31.5	93.7	364.3	118.38	66.74	1,165.50	180.37	0.99
1955	301.4	37.1	95.3	433.8	143.76	75.27	1,153.28	206.93	0.95
1956*	336.0‡	35.9‡	102.3‡	474.4†	157.67	73.01	1,218.11	222.35	0.94

Source: Federal Power Commission. *Twelve months ended November 1. †Small amount of energy generated from wood included in 1956. ‡Preliminary.

CAPACITY

Changes in Installed Generating Capacity—Mw (Nameplate)

	New Additions	Retirements	Adjustments* Plus	Adjustments* Minus	Net Additions
1947					
Hydro	133	12	5	4	122
Steam	1,835	144	46	15	1,722
Internal Combustion	179	19	5	4	161
Total	**2,147**	**175**	**56**	**23**	**2,005**
1948					
Hydro	697	30	29	15	681
Steam	3,197	71	178	35	3,269
Internal Combustion	289	26	33	8	288
Total	**4,183**	**127**	**240**	**58**	**4,238**
1949					
Hydro	1,070	85	30	13	1,002
Steam	5,356	108	238	150	5,336
Internal Combustion	185	21	46	8	202
Total	**6,611**	**214**	**314**	**171**	**6,540**
1950					
Hydro	1,038	17	14	14	1,021
Steam	4,693	129	205	77	4,692
Internal Combustion	72	17	62	11	106
Total	**5,803**	**163**	**281**	**102**	**5,819**
1951					
Hydro	1,187	13	28	9	1,193
Steam	5,670	176	124	85	5,533
Internal Combustion	111	29	66	18	130
Total	**6,968**	**218**	**218**	**112**	**6,856**
1952					
Hydro	1,460	14	116	11	1,551
Steam	4,892	142	316	252	4,814
Internal Combustion	105	43	45	21	86
Total	**6,457**	**199**	**477**	**284**	**6,451**
1953					
Hydro	1,632	21	24	9	1,626
Steam	7,803	221	129	155	7,556
Internal Combustion	86	34	46	4	94
Total	**9,521**	**276**	**199**	**168**	**9,276**
1954					
Hydro	1,148	19	67	30	1,166
Steam	10,287	450	211	181	9,867
Internal Combustion	97	39	38	39	57
Total	**11,532**	**508**	**316**	**250**	**11,090**
1955					
Hydro	1,428	19	397	13	1,793
Steam	10,323	547	363	128	10,011
Internal Combustion	80	42	46	8	76
Total	**11,831**	**608**	**806**	**149**	**11,880**
1956‡					
Total	**6,150**	**687**	**350**	**35**	**5,778**

Source: Edison Electric Institute and Federal Power Commission. †Estimated. *Adjustments are result of reclassification in ownership between industrial and electric utility plants and rerating of turbines within the electric utility industry.

Number and Installed Capacity of Electric Utility Generating Plants By States and Type of Prime Mover—Kw

November 1, 1956

	Number of Utilities [a]	Number of Plants [b]	Total Capacity	Hydro		Steam		Internal Combustion	
				Number	Capacity	Number	Capacity	Number	Capacity
UNITED STATES	1,395	3,564	119,378,128	1,373	25,467,765	1,042	91,508,165	1,149	2,402,198
New England	92	307	5,391,069	198	1,110,139	73	4,171,550	36	109,380
Maine	19	84	637,153	57	350,633	9	244,650	18	41,870
New Hampshire	12	45	475,330	38	259,064	6	213,250	1	3,016
Vermont	13	71	261,905	56	186,810	8	58,650	7	16,445
Massachusetts	31	67	2,170,269	30	179,587	30	1,960,180	7	30,502
Rhode Island	6	10	401,352	3	2,475	5	388,330	2	10,547
Connecticut	11	30	1,445,060	14	131,570	15	1,306,490	1	7,000
Middle Atlantic	81	295	18,335,985	153	1,396,712	117	16,866,919	25	72,354
New York	42	197	8,283,244	141	954,787	42	7,280,845	14	47,612
New Jersey	10	19	2,952,886	2	6,080	15	2,941,624	2	5,182
Pennsylvania	29	79	7,099,855	10	435,845	60	6,644,450	9	19,560
East North Central	268	630	27,037,487	257	860,180	224	25,815,068	149	362,239
Ohio	50	86	7,619,118	5	10,525	61	7,564,730	20	43,863
Indiana	40	66	4,772,298	14	35,170	37	4,700,280	15	36,848
Illinois	53	101	6,856,259	10	47,909	58	6,717,458	33	90,892
Michigan	62	184	5,136,685	107	395,307	36	4,610,625	41	130,753
Wisconsin	63	193	2,653,127	121	371,269	32	2,221,975	40	59,883
West North Central	445	849	8,553,110	112	1,266,397	225	6,309,376	512	977,337
Minnesota	81	175	1,866,298	39	156,171	53	1,528,365	83	181,762
Iowa	91	196	1,594,887	25	138,921	49	1,193,791	122	262,175
Missouri	68	104	1,746,710	5	193,025	35	1,419,815	64	133,870
North Dakota	14	45	502,777	1	240,000	19	224,790	25	37,987
South Dakota	33	64	529,277	7	324,496	11	137,350	46	67,431
Nebraska	74	135	828,645	31	207,874	20	510,265	84	110,506
Kansas	84	130	1,484,516	4	5,910	38	1,295,000	88	183,606
South Atlantic	125	364	15,685,398	164	3,426,403	122	12,086,345	78	172,650
Delaware	4	6	223,898	.....	.....	4	216,100	2	7,798
Maryland	11	23	1,498,917	3	271,325	13	1,210,000	7	17,592
District of Columbia	2	3	533,000	1	3,000	2	530,000	.....	.....
Virginia	23	64	2,021,261	37	399,504	15	1,592,800	12	28,957
West Virginia	8	33	2,176,541	10	100,880	15	2,071,665	8	3,996
North Carolina	29	86	3,564,186	57	1,208,018	19	2,336,750	10	19,418
South Carolina	12	38	1,651,519	26	931,005	8	718,500	4	2,014
Georgia	8	38	1,724,760	26	500,010	11	1,222,750	1	2,000
Florida	28	73	2,291,316	4	12,661	35	2,187,780	34	90,875
East South Central	40	116	12,224,858	40	3,568,080	50	8,627,485	26	29,293
Kentucky	11	27	2,977,132	5	540,860	19	2,428,000	3	8,272
Tennessee	7	36	4,807,963	23	1,736,000	10	3,067,500	3	4,463
Alabama	4	26	3,809,870	12	1,291,220	11	2,516,250	3	2,400
Mississippi	18	27	629,893	.....	.....	10	615,735	17	14,158
West South Central	156	343	10,203,937	37	945,000	113	8,839,879	193	419,058
Arkansas	17	33	1,167,420	8	388,340	12	745,895	13	33,185
Louisiana	30	59	1,659,251	.....	.....	16	1,562,750	43	96,501
Oklahoma	39	66	1,423,524	4	165,700	23	1,171,834	39	85,990
Texas	70	185	5,953,742	25	390,960	62	5,359,400	98	203,382
Mountain	135	371	6,131,875	190	3,704,374	69	2,221,197	112	206,304
Montana	8	25	925,152	18	850,910	4	71,800	3	2,442
Idaho	12	47	781,695	42	777,380	.....	.....	5	4,315
Wyoming	18	50	236,108	19	143,382	12	79,320	19	13,406
Colorado	36	76	947,448	28	247,517	22	662,318	26	37,613
New Mexico	15	32	453,290	4	24,910	11	388,400	17	39,980
Arizona	13	41	1,632,745	12	980,040	11	586,950	18	65,755
Utah	25	82	513,549	57	93,255	8	388,409	17	31,885
Nevada	8	18	641,888	10	586,980	1	44,000	7	10,908
Pacific	53	289	15,814,409	222	9,190,480	49	6,570,346	18	53,583
Washington	20	53	4,205,950	39	3,980,454	8	221,500	6	3,996
Oregon	14	72	2,256,306	54	2,052,019	12	198,710	6	5,577
California	19	164	9,352,153	129	3,158,007	29	6,150,136	6	44,010

NOTES: [a] Total includes 100 duplications because of utilities having generating plants in more than one state.
[b] Each type of prime mover at combination plants is counted as a separate plant.
Source: Federal Power Commission.

PRODUCTION

Installed Capacity by Type of Prime Mover—Mw

	Fuel			Hydro			Total	
	Capacity	% Total	Annual Change	Capacity	% Total	Annual Change	Capacity	Annual Change
1940.....	28,703	71.9	844 (3.0%)	11,224	28.1	220 (2.0%)	39,927	1,064 (2.7%)
1941.....	30,588	72.1	1,885 (6.6%)	11,817	27.9	593 (5.3%)	42,405	2,478 (6.2%)
1942.....	32,211	71.5	1,623 (5.3%)	12,842	28.5	1,025 (8.7%)	45,053	2,648 (6.2%)
1943.....	34,068	71.0	1,857 (5.8%)	13,883	29.0	1,041 (8.1%)	47,951	2,898 (6.4%)
1944.....	34,603	70.3	535 (1.6%)	14,586	29.7	703 (5.1%)	49,189	1,238 (2.6%)
1945.....	35,199	70.2	596 (1.7%)	14,912	29.8	326 (2.2%)	50,111	922 (1.9%)
1946.....	35,468	70.5	269 (0.8%)	14,849	29.5	−63	50,317	206 (0.4%)
1947.....	37,351	71.4	1,883 (5.3%)	14,971	28.6	122 (0.8%)	52,322	2,005 (4.0%)
1948.....	40,908	72.3	3,557 (9.5%)	15,652	27.7	681 (4.5%)	56,560	4,238 (8.1%)
1949.....	46,446	73.6	5,538 (13.5%)	16,654	26.4	1,002 (6.4%)	63,100	6,540 (11.6%)
1950.....	51,244	74.4	4,798 (10.3%)	17,675	25.6	1,021 (6.1%)	68,919	5,819 (9.2%)
1951.....	56,907	75.1	5,663 (11.1%)	18,868	24.9	1,193 (6.7%)	75,775	6,856 (9.9%)
1952.....	61,807	75.1	4,900 (8.6%)	20,419	24.9	1,551 (8.2%)	82,226	6,451 (8.5%)
1953.....	69,457	75.9	7,650 (12.4%)	22,045	24.1	1,626 (8.0%)	91,502	9,276 (11.3%)
1954.....	79,382	77.4	9,925 (14.3%)	23,211	22.6	1,166 (5.3%)	102,592	11,090 (12.1%)
1955.....	89,468	78.2	10,086 (12.7%)	25,004	21.8	1,793 (7.7%)	114,472	11,880 (11.6%)
Nov. 1, 1956	93,910	78.7	....	25,468	21.3	....	119,378	....
1956‡.....	94,231	78.4	4,763 (5.3%)	26,019	21.6	1,015 (4.1%)	120,250	5,778 (5.0%)

Source: Federal Power Commission. ‡Estimated by Electrical World.

Generating Capacity by Ownership—Mw

	Power Companies		Federal		Municipal, State and Power District		Cooperatives	
	Capacity	% Total	Capacity	% Total	Capacity	% Total	Capacity	% Total
1940.....	34,398	86.2	1,944	4.9	3,585†	8.9		
1941.....	36,041	85.0	2,371	5.6	3,993†	9.4		
1942.....	37,442	83.1	3,216	7.1	4,395†	9.8		
1943.....	39,128	81.6	4,322	9.0	4,501†	9.4		
1944.....	39,733	80.8	4,886	9.9	4,570†	9.3		
1945.....	40,307	80.4	5,081	10.2	4,723†	9.4		
1946.....	40,335	80.2	4,920	9.8	5,062†	10.0		
1947.....	41,987	80.2	5,027	9.6	5,141	9.9	167	0.3
1948.....	45,381	80.2	5,526	9.8	5,453	9.6	200	0.4
1949.....	50,484	80.0	6,210	9.8	6,168	9.8	238	0.4
1950.....	55,175	80.1	6,921	10.0	6,511	9.4	312	0.5
1951.....	60,192	79.4	8,099	10.7	6,993	9.2	491	0.6
1952.....	64,349	78.4	9,678	11.8	7,667	9.3	532	0.6
1953.....	71,201	77.8	11,358	12.4	8,343	9.1	600	0.7
1954.....	79,127	77.1	13,567	13.2	9,130‡	8.9	768‡	0.7
1955.....	86,887	75.9	16,962	14.8	9,822‡	8.6	801‡	0.7
Nov. 1, 1956	90,334	75.7	18,047	15.1	10,206‡	8.5	791‡	0.7
1956‡.....	90,732	75.5	18,431	15.3	10,296	8.6	791	0.7

Source: Federal Power Commission. †Includes Cooperatives. 1940 and after excludes publicly owned transit systems. ‡Estimated by Electrical World.

PRODUCTION

Source and Disposal of Energy—Millions of Kwhr

	Production				Less Energy Used by	Total for		Sales to Ultimate
	Fuel	Hydro	Total Production	Add Net Imports	Producer	Distribution	Losses	Consumers
1940.....	94,516	47,321	141,837	93[illegible]	7,268	135,506	16,863	118,643
1941.....	113,925	50,863	164,788	927	6,335	159,380	19,320	140,060
1942.....	122,109	63,871	185,979	1,448	6,611	180,816	21,409	159,407
1943.....	144,127	73,632	217,759	1,537	8,729	210,567	24,678	185,889
1944.....	154,244	73,945	228,189	1,597	6,541	223,245	25,084	198,161
1945.....	142,516	79,970	222,486	1,773	3,368	220,891	27,333	193,558
1946.....	144,772	78,406	223,178	1,666	4,576	220,268	29,474	190,794
1947.....	177,313	78,426	255,739	1,269	6,186	250,822	33,241	217,581
1948.....	200,228	82,470	282,698	1,113	6,368	277,443	36,703	240,740
1949.....	201,351	89,748	291,100	1,004	5,887	286,217	37,675	248,542
1950.....	233,203	95,938	329,141	1,283	8,445	321,979	41,440	280,539
1951.....	270,922	99,751	370,673	1,721	9,356	363,038	44,870	318,168
1952.....	294,121	105,102	399,224	1,758	10,731	390,251	47,727	342,524
1953.....	337,432	105,233	442,665	1,365	9,398	434,632	50,388	384,244
1954.....	364,617	107,069	471,686	1,688	10,864	462,510	51,606	410,904
1955.....	434,063	112,975	547,038	3,310	13,274	537,074	56,153	480,921
1956*.....	479,605	121,835	601,441	4,000	17,481	587,960	58,960	529,000

Source: Federal Power Commission and Edison Electric Institute. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classification. *Estimated.

Production of Electric Energy by Ownership — Millions of Kwhr

	Power Companies		Federal Agencies		Municipal, State & Power District Systems		Cooperatives	
	Production	% Total	Production	% Total	Production	% Total	Production	%Total
1940.....	125,411	88.4	8,583	6.1	7,843†	5.5	....	...
1941.....	144,289	87.6	10,794	6.6	9,705†	5.9	....	...
1942.....	158,052	85.0	16,894	9.1	11,033†	5.9	....	...
1943.....	180,248	82.8	24,484	11.2	13,027†	6.0	....	...
1944.....	185,850	81.4	28,866	12.7	13,473†	5.9	....	...
1945.....	180,926	81.3	28,000	12.6	13,560†	6.1	....	...
1946.....	181,020	81.1	26,960	12.1	15,198†	6.8	....	...
1947.....	208,106	81.4	29,877	11.7	17,352	6.9	404	0.2
1948.....	228,231	80.7	35,373	12.5	18,444	6.5	650	0.2
1949.....	233,112	80.1	38,102	13.1	19,122	6.6	764	0.3
1950.....	266,860	81.1	40,387	12.3	20,908	6.4	986	0.3
1951.....	301,845	81.4	44,120	11.9	23,444	6.3	1,264	0.3
1952.....	322,126	80.7	52,492	13.2	23,080	5.8	1,526	0.4
1953.....	354,271	80.0	58,064	13.1	28,433	6.4	1,896	0.4
1954.....	370,970	78.6	67,804	14.4	30,436‡	6.5	2,476‡	0.5
1955.....	420,869	76.9	89,064	16.3	34,026‡	6.2	3,079‡	0.6
1956*....	459,937	76.5	100,670	16.7	37,423‡	6.2	3,411‡	0.6

Source: Federa Power Commission. †Includes Cooperatives. *Estimated. ‡Estimated by Electrical World.

Manufacturers Shipments Jumped

The electrical manufacturing industry chalked up a new record in 1956 by shipping a total of $19.6 billion of electrical products. This 11.5% increase was posted over the previous high of $17.6 billion set in 1955.

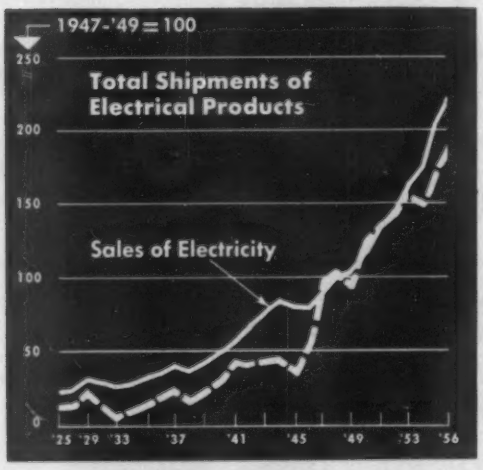
Of all the major categories of electrical equipment insulated wire and cable made the biggest gain percentagewise. In 1956 shipments rose 29.8% over 55's $1.5 billion to a high of $1.9 billion. Underlying this major advance was the commercial and industrial construction boom which ran at a peak throughout '55.

Further evidence of the construction boom and the snowballing trend towards modernization and automation of industrial plants can be seen in the 20% gain in shipments of industrial electrical apparatus in 1956. Last year manufacturers shipped over $2.9 billion of such products almost $500 million more than 1955.

To power new commercial and industrial buildings, the industry shipped $680 million of building equipment and supplies.

Illuminating equipment, spurred by the building

Total Shipments of Electrical Products

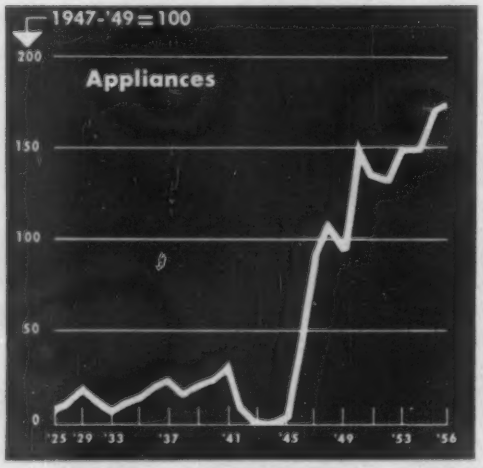


The data shown in this tabulation are based upon total industry shipments including exports and interplant transfers of electrical products which are considered to cover, not only those products included in the Electrical Machinery Group as defined by the U. S. Census of Manufacturers, but also lighting fixtures, steam engines and turbines, household and commercial refrigeration machinery, air conditioning machinery, household laundry equipment, vacuum cleaners and electrical insulating materials such as porcelain, mica, laminated products, vulcanized fiber, varnished fabric and paper.

Non-Electrical Products: Including non-electrical defense and war material, manufactured within the industry, **have not been** included in these data.

	$ Millions	Index 1947–'49 =100
1945...	4,110.2	39.9
1946...	6,053.9	58.8
1947...	10,048.2	97.7
1948...	10,858.5	105.6
1949...	9,948.9	96.7
1950...	13,068.5	127.1
1951...	14,168.3	137.7
1952...	14,883.6	144.8
1953...	16,310.4	158.7
1954...	15,695.1	152.6
1955...	17,584.5	171.0
1956...	19,615.0	190.8

Appliances



Appliances, includes, electric household refrigerators, electric farm and home freezers, electric ranges, electric water heaters, electric housewares, electric fans, electric commercial cooking equipment, electric dehumidifiers, electric household food waste disposers and dishwashers, packaged room air conditioners, electric dryers, electric ironers, electric washing machines, vacuum cleaners, and radio and television receiving sets.

	$ Millions	Index 1947–'49 =100
1945...	145.0	5.2
1946...	1,231.6	44.6
1947...	2,530.6	91.6
1948...	3,033.5	109.8
1949...	2,721.2	98.5
1950...	4,216.5	152.6
1951...	3,791.2	137.2
1952...	3,688.6	133.5
1953...	4,155.2	150.3
1954...	4,145.1	150.1
1955...	4,675.8	169.3
1956...	4,800.0	173.8

Industrial Apparatus

11.5% to $19.6 Billion in 1956

boom, hit a record $830 million. This compares with the $737.8 million of lighting equipment shipped the previous year. Several nationwide lighting campaigns can also take some of the credit for the increase, especially in the residential field.

Generation, transmission, and distribution equipment shipments posted a 10.4% gain over the $1.6 billion shipped in 1955. The $1.8 billion of GT&D equipment shipped last year just topped the high of $1.78 billion set in 1953.

Shipments of electrical insulating materials rose to better than $401 million—20% more than the $334.2 million shipped a year earlier.

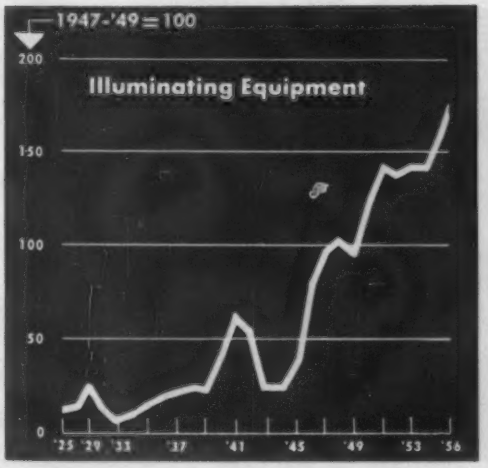
Appliances alone accounted for $4.8 billion of the $19.6 billion of electrical products shipped in 1956. Although appliance shipments had to struggle against record '55 shipments of $4.7 billion, they still managed a gain of 2.7%.

For a detailed analysis of how individual appliances fared last year see page 146.

Illuminating Equipment

	$ Millions	Index 1947–'49 =100
1945...	187.1	40.0
1946...	383.9	82.0
1947...	460.8	98.4
1948...	483.5	103.3
1949...	459.6	98.2
1950...	582.0	124.3
1951...	667.4	142.6
1952...	647.8	138.4
1953...	670.3	143.3
1954...	670.7	143.4
1955...	737.8	157.7
1956...	830.0	177.4

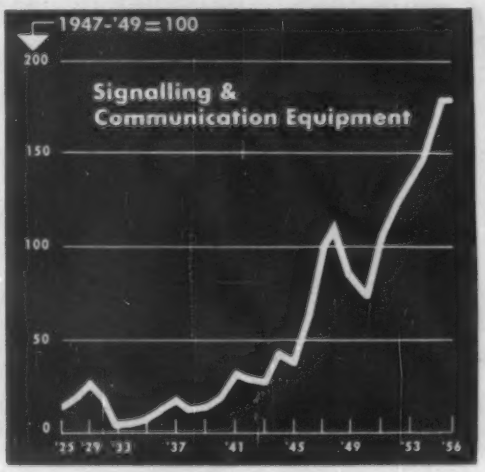
Illuminating Equipment includes, industrial, commercial and residential lighting equipment; aviation ground lighting, floodlighting and street lighting equipment; vehicular, railway and other lighting equipment; and portable lamps.



Signal and Communication Equipment

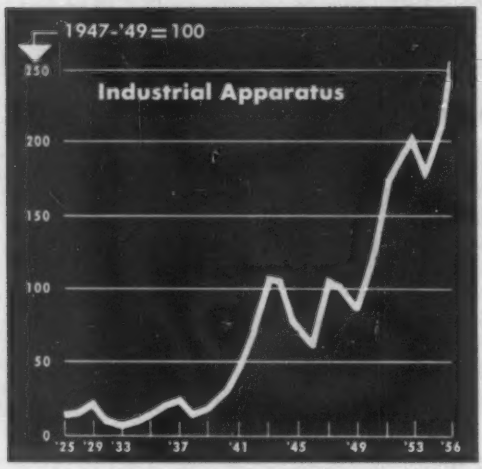
	$ Millions	Index 1947–'49 =100
1945...	283.3	40.6
1946...	468.5	67.1
1947...	702.6	100.6
1948...	791.1	113.3
1949...	599.9	85.9
1950...	535.8	76.7
1951...	731.7	104.8
1952...	889.8	127.4
1953...	961.1	137.6
1954...	1,053.7	151.0
1955...	1,260.0	180.6
1956...	1,260.0	180.6

Signaling and Communication Equipment includes, signaling apparatus, telephone and telegraph equipment, and electric railway signals and attachments.



Insulated Wire and Cable

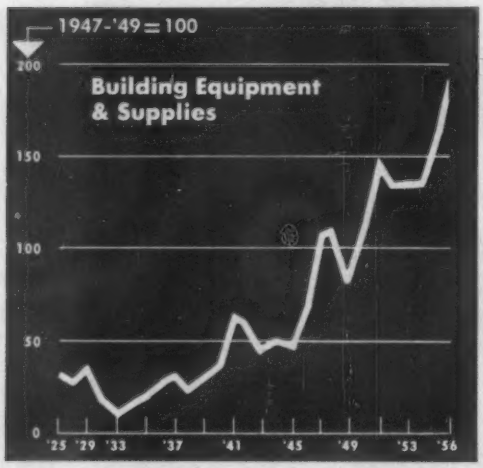
Industrial Apparatus



Industrial Apparatus includes, carbon products, commutators, electronic tubes, (except radio and cathode ray), welding wire, welding machines, resistance welders, industrial heating units and devices, industrial controls, induction and dielectric heating apparatus, mining belt conveyors, motors and generators (except large apparatus), mining and industrial electric locomotives, metallic rectifiers, and renewal parts for motors, generators and mining and industrial locomotives.

	$ Millions	Index 1947–'49 = 100
1945...	869.8	75.6
1946...	739.8	64.3
1947...	1,234.5	107.3
1948...	1,193.4	103.8
1949...	1,020.0	88.7
1950...	1,422.0	123.7
1951...	1,985.6	172.7
1952...	2,214.3	192.5
1953...	2,351.2	204.5
1954...	2,120.5	184.5
1955...	2,432.6	211.7
1956...	2,919.0	254.0

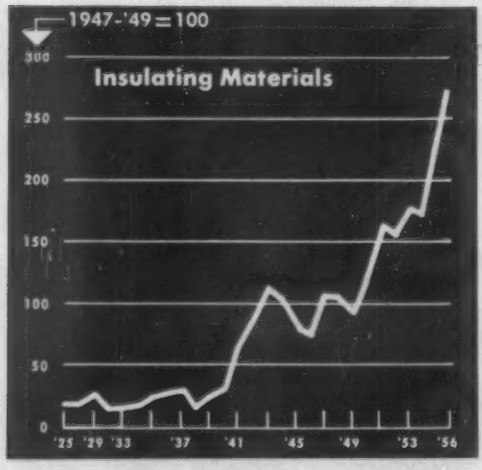
Building Equipment and Supplies



Building Equipment and Supplies includes, conduit fittings, metallic and plastic outlet and switch boxes, rigid steel conduit and electrical metallic tubing and fittings, wiring devices, molded case breakers, busways, fuses, switch and enclosed breakers, and panelboards and distribution boards.

	$ Millions	Index 1947–'49 = 100
1945...	176.4	49.3
1946...	234.5	65.6
1947...	378.1	105.8
1948...	395.7	110.8
1949...	297.9	83.4
1950...	403.7	113.0
1951...	533.7	149.4
1952...	474.6	132.8
1953...	478.2	133.9
1954...	491.7	137.6
1955...	590.1	165.2
1956...	680.0	190.3

Insulating Materials



Electrical Insulating Materials includes, standard and special dry process electrical porcelain, steatite electrical products, laminated products, manufactured electrical mica, varnished fabric and paper, varnished tubing and saturated sleeving, and vulcanized fiber.

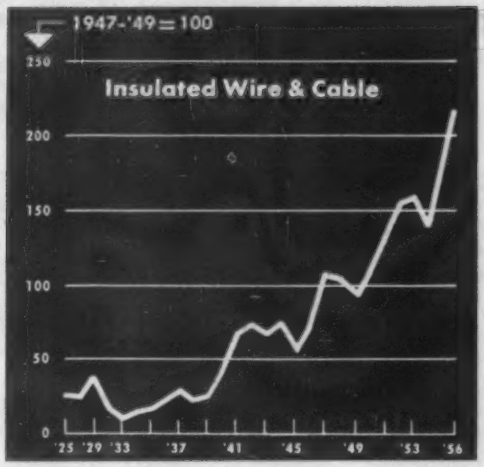
	$ Millions	Index 1947–'49 = 100
1945...	127.7	86.0
1946...	113.4	76.3
1947...	154.6	104.1
1948...	156.4	105.4
1949...	134.2	90.4
1950...	193.2	130.1
1951...	248.9	167.8
1952...	236.9	159.6
1953...	274.1	184.7
1954...	267.4	180.2
1955...	334.2	225.2
1956...	401.0	270.2

APPLIANCES

Insulated Wire and Cable

	$ Millions	Index 1947–'49 =100
1945...	445.7	53.8
1946...	603.2	72.7
1947...	895.1	107.9
1948...	838.7	101.1
1949...	752.8	90.8
1950...	879.9	106.2
1951...	1,097.1	132.4
1952...	1,265.9	152.8
1953...	1,310.5	158.1
1954...	1,140.7	137.6
1955...	1,483.0	178.8
1956...	1,925.0	232.2

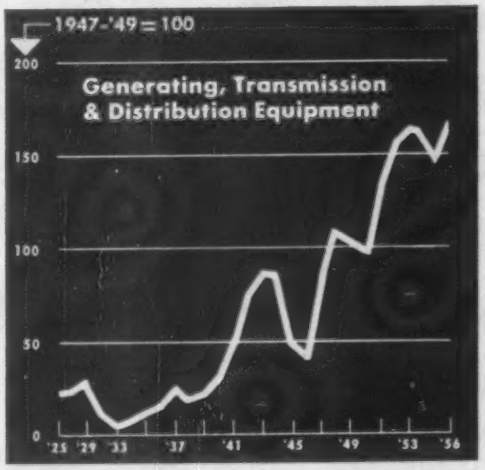
Insulated Wire and Cable includes, rubber and thermoplastic power and control cable, asbestos insulated wire and cable, flexible cords, cord sets, fixture and appliance wire, magnet wire, paper power cable, building wire and cable, portable molded rubber sheathed cord and cable, varnished cambric cable, weatherproof and slow-burning wire, communication and signal wire and cable, automotive, aircraft and marine wire and cable, and non-metalic sheathed cable.



Generating, Transmission & Distribution Equipment

	$ Millions	Index 1947–'49 =100
1945...	546.7	50.5
1946...	469.6	43.4
1947...	911.5	84.2
1948...	1,202.6	111.1
1949...	1,132.3	104.6
1950...	1,095.9	101.3
1951...	1,437.3	132.8
1952...	1,709.7	158.0
1953...	1,780.1	164.5
1954...	1,768.3	163.4
1955...	1,630.0	150.6
1956...	1,800.0	166.3

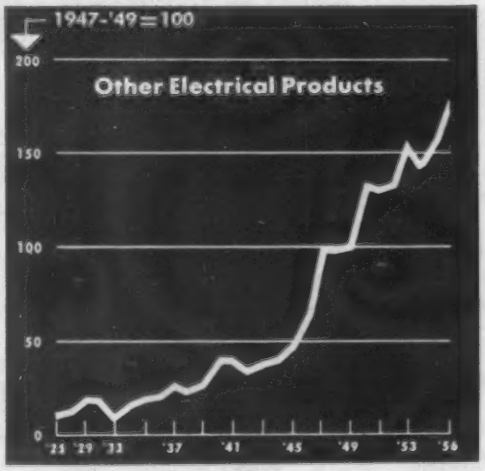
Generation, Transmission, and Distribution Equipment includes, power capacitors, electric measuring and test equipment, transmission and distribution voltage regulators, hydraulic turbines, high voltage insulators, lightning protective devices, generating and converting apparatus, marine turbine-propulsion, overhead trolley line materials, switchgear, power and distribution transformers, land steam and gas turbines, pole line hardware, rail bonds, transmission hardware, and other related products.



Other Electrical Products

	$ Millions	Index 1947–'49 =100
1945...	1,328.5	47.5
1946...	1,809.4	64.8
1947...	2,780.4	99.5
1948...	2,763.5	98.9
1949...	2,830.9	101.3
1950...	3,739.4	133.8
1951...	3,675.4	131.6
1952...	3,756.0	134.5
1953...	4,329.7	155.0
1954...	4,037.0	144.6
1955...	4,441.0	159.1
1956...	5,000.0	179.1

Other Electrical Products includes, radio, electronic and television transmission and communication equipment, automatic temperature controls, specialty capacitors, specialty transformers, ballast (fluorescent), time switches, X-ray tubes, X-ray apparatus, land transportation motors and controls, electric lamps, air conditioning and commercial refrigeration equipment, radio receiving-type tubes, cathode ray tubes, engine electrical equipment, phonographs, phonograph records, recording devices, storage batteries, primary batteries, electrical hearing aids, lamp components, Christmas tree lighting outfits, and other related products.



How the Market Fared: Sales of Appliances, Lamps,

	1955			1956			Units % Change 1956 vs	Dollars % Change 1956 vs
	Units	Aver. Price	Retail Value	Units	Aver. Price	Retail Value	1955	1955
Air Conditioners, Room	1,270,000	$300.00	$381,000,000	1,765,000	$275.00	$485,375,000	+39.0	+27.4
Bed Coverings	1,460,000	30.50	44,530,000	1,950,000	28.00	54,600,000	+33.6	+22.6
Blenders	405,000	35.59	14,415,000	465,000	34.95	16,250,000	+14.8	+12.7
Broilers	1,545,000	49.95	77,172,700	750,000	39.95	29,962,000	−51.5	−61.2
Cleaners, Vacuum:								
Floor Type	3,270,400	87.36	285,702,000	3,725,000	81.78	304,630,000	+13.9	+ 6.6
Hand Type	106,700	31.72	3,384,500	75,000	32.00	2,400,000	−29.7	−29.1
Clocks	7,200,000	6.95	50,040,000	9,750,000	6.75	65,812,000	+35.4	+31.5
Coffee Makers, Automatic	3,675,000	19.50	71,662,500	5,100,000	19.35	98,685,000	+38.8	+37.7
Corn Poppers	780,000	5.18	4,040,400	640,000	4.95	3,168,000	−17.9	−21.6
Dehumidifiers	96,000	127.00	12,192,000	275,000	125.00	34,375,000	+186.5	+181.9
Dishwashers	295,000	306.00	90,270,000	400,000	290.00	116,000,000	+35.6	+28.5
Dryers, Clothes, Total	1,396,600	221.36	309,050,000	1,660,000	222.75	369,780,000	+18.9	+19.7
Electric	1,027,600	210.93	216,752,000	1,190,000	212.00	252,280,000	+15.8	+16.4
Gas	369,000	250.13	92,298,000	470,000	250.00	117,500,000	+27.4	+27.3
Fans:								
Attic	140,000	125.00	17,500,000	110,000	125.00	13,750,000	−21.4	−21.4
Desk & Bracket	2,525,000	19.95	50,373,000	2,400,000	19.95	47,850,000	− 5.0	− 5.0
Hassock & Floor	250,000	41.86	10,464,000	135,000	49.50	6,682,000	−46.0	−36.1
Ventilating, Wall & Ceiling	860,000	35.00	30,100,000	1,150,000	34.95	40,192,000	+33.7	+33.5
Window Ventilating	1,645,000	49.95	82,168,000	2,525,000	47.50	119,937,000	+53.5	+46.0
Portable Roll-Abouts	165,000	77.50	12,787,000	270,000	67.00	18,090,000	+63.6	+41.5
Floor Polishers	375,000	54.00	20,250,000	415,000	57.50	23,862,500	+10.7	+17.8
Food Waste Disposers	520,000	115.00	59,800,000	590,000	110.00	64,900,000	+13.5	+ 8.5
Freezers, Home	1,100,000	399.95	439,945,000	975,000	389.95	380,200,000	−11.4	−13.6
Fryers, Deep Fat	1,925,000	17.50	33,687,000	1,350,000	15.50	20,925,000	−29.9	−37.9
Frypan-Skillets	2,660,000	19.00	50,540,000	6,300,000	17.95	113,085,000	+136.8	+123.8
Heaters, Convector & Radiant	1,680,000	29.83	50,113,500	1,811,000	28.78	52,124,000	+ 7.8	+ 4.0
Fan-Forced & Fan-Htrs	880,000	19.50	17,160,000	976,000	19.50	19,032,000	+10.9	+10.9
Non-Fan Forced	270,000	24.00	6,480,000	290,000	24.00	6,960,000	+ 7.4	+ 7.4
Wall Type	530,000	49.95	26,473,500	545,000	47.95	26,132,000	+ 2.8	− 1.3
Heating Pads	1,980,000	6.15	12,177,000	2,215,000	5.95	13,179,000	+11.9	+ 8.2
Hotplates	950,000	7.75	7,362,500	760,000	7.95	6,042,000	−20.0	−17.9
Ironers	87,100	210.70	18,352,000	60,000	215.00	12,900,000	−31.1	−29.7

Source: "Electrical Merchandising"

Appliance Sales Still Going Up

ROBERT W. ARMSTRONG, Managing Editor, Electrical Merchandising

The appliance-TV industry has again broken all records for dollar volume.

Total sales in 1956 reached $8.4-billion (retail value), a $500-million gain over the previous record of 1955. But, according to the annual statistical issue of Electrical Merchandising, a McGraw-Hill publication which compiles industry figures, the new peak was achieved despite declines among some of the traditional load-building appliances like refrigerators, standard electric ranges, water heaters, and freezers. Conversely, the gains in both unit and dollar sales shown in the above table are attributable to substantial jumps made by air conditioners (up 39% in units), clothes dryers (gas up 27.4%, electric up 15.8%), dishwashers (up 35.6%), built-in ranges (up 92.5%).

Despite optimism among manufacturers, it's not likely that refrigerators, water heaters, and standard electric ranges will make any substantial recovery this year. The reasons: (1) These appliances are deep in a replacement and trade-in market; (2) The probable further decline in home-building starts. The first of these two reasons is probably the more important.

Well over three-fourths of the refrigerators now in use are post war models—ten years old or less. According to EM's annual replacement and trade-in survey, 54.2% of refrigerator sales and 42.7% of range sales involve a trade-in. For retailers in today's frantic price-

in 1955 their share of the business

Radios, and TV in 1956 as Compared with 1955

	1955			1956			Units % Change 1956 vs 1955	Dollars % Change 1956 vs 1955
	Units	Aver. Price	Retail Value	Units	Aver. Price	Retail Value		
Ironers, Automatic Dry	2,495,000	$10.25	$25,575,000	2,130,000	$9.95	$21,193,500	−14.6	−17.1
Traveler	440,000	8.25	3,630,000	435,000	7.95	3,458,000	− 1.1	− 4.7
Steam	4,995,000	16.75	83,666,000	6,150,000	15.95	98,092,000	+23.1	+17.2
Kitchen Cabinets, Steel	4,046,000	.....	209,328,000	3,641,000	.....	188,395,000	−10.0	−10.0
Lamp Bulbs & Tubes, Total	2,479,000,000	.....	723,500,000	2,610,000,000	.....	830,500,000	+ 5.3	+14.8
Fluorescent	95,000,000	.....	145,000,000	105,000,000	.....	175,000,000	+10.5	+20.7
Large Incandescent	1,009,000,000	.....	300,000,000	1,080,000,000	.....	350,000,000	+ 7.0	+16.7
Photo	525,000,000	.....	79,000,000	595,000,000	.....	93,000,000	+13.3	+17.7
Miniature	500,000,000	.....	165,000,000	455,000,000	.....	175,000,000	− 9.0	+ 6.1
Christmas	350,000,000	.....	34,500,000	375,000,000	.....	37,500,000	+ 7.1	+ 8.7
Lawn Mowers, Power	2,750,000	86.00	236,500,000	3,200,000	79.00	252,800,000	+16.4	+ 6.9
Mixers, Food:								
Standard	1,615,000	44.25	71,464,000	1,600,000	44.00	70,400,000	− 0.9	− 1.5
Portable	1,625,000	19.50	31,687,500	2,645,000	18.50	48,932,500	+62.8	+54.4
Oil Space Heaters	408,000	98.00	39,974,000	375,000	98.00	36,750,000	− 8.1	− 8.1
Phonographs & Record Players								
Single Players	2,233,700	69.00	154,125,000	3,600,000	69.00	248,400,000	+61.2	+61.2
Combination Units	509,000	200.00	101,800,000	595,000	198.00	117,810,000	+16.9	+15.7
Attachments	380,000	35.00	13,300,000	270,000	35.00	9,450,000	−28.9	−28.9
Radios:								
Home	3,393,800	28.75	97,575,000	3,800,000	25.00	95,000,000	+12.0	− 2.6
Portable	2,027,500	34.95	70,861,000	2,900,000	39.00	113,100,000	+43.0	+59.6
Clock	2,243,700	33.95	76,173,600	2,500,000	34.00	85,000,000	+11.4	+11.6
Ranges, Total	1,600,000	265.00	423,800,000	1,585,000	260.00	412,645,000	− 0.9	− 2.6
Standard	1,400,000	262.00	366,800,000	1,200,000	255.00	306,000,000	−14.3	−16.6
Built-In	200,000	285.00	57,000,000	385,000	277.00	106,645,000	+92.5	+87.1
Refrigerators	4,200,000	315.00	1,323,000,000	3,700,000	325.00	1,202,500,000	−11.9	− 9.1
Shavers	4,750,000	25.50	121,125,000	6,900,000	21.00	145,600,000	+45.3	+20.2
Television, B & W	7,756,500	225.00	1,745,212,000	7,200,000	190.00	1,368,000,000	− 7.2	−21.6
Toasters, Automatic	3,250,000	18.25	59,312,500	3,625,000	18.95	68,693,000	+11.5	+15.8
Waffle Irons-Sand. Grills	995,000	19.00	18,905,000	965,000	19.95	19,250,000	− 3.0	+ 1.8
Washing Machines:								
Automatic & Semi-Automatic	3,123,000	270.70	845,407,000	3,460,000	275.00	951,500,000	+10.8	+12.5
Wringer & Spinner	1,268,000	147.50	187,030,000	1,253,000	151.00	189,203,000	− 1.2	+ 1.2
Water Heaters, Storage	900,000	115.00	103,500,000	870,000	115.00	100,050,000	− 3.3	− 3.3
Water Softeners	403,000	232.00	93,496,000	475,000	257.00	122,075,000	+17.9	+30.6
Water Systems	788,000	165.00	130,000,000	775,000	155.00	120,125,000	− 1.6	− 7.6

New devices push volume to a new record despite lag in refrigerators, freezers, water heaters. More gains and more competition expected this year

cutting market, that's the hardest kind of sale to make. By contrast, only 2.8% of dishwasher sales mean a trade, only 1.8% of air conditioners, 6% of clothes dryers. Clothes washers, which had the highest trade-in percentage of any appliance (54.8%), were one of the few bread-and-butter appliances to make any gains in 1956. But washers can't be lumped with refrigerators or ranges because the automatic units (up 10.8%) are still replacing wringer models (off 1.2%).

Some appliances sold well in 1956 without making anybody any more money. Television is a good example. Although unit sales were off only 7.2%, dollar volume fell 21.6%—largely because of the rise in popularity of low-cost portable models, lowering the average retail price to $190, and accounting for about 1.5-million of total unit sales. Home radios actually gained 12% in unit sales, fell off 2.6% in dollars.

At the dealer level, the contrast between volume and profits was more widespread and considerably sharper. Many who did a bigger volume in 1956 than in 1955 were lucky to make as much money. The reason, of course, was a competition which forced real margins down to the subsistence point. Still another tear in the retail profit picture was the skyrocketing increase in sales by builders. For example, manufacturers estimated that builders were getting about 80% of the built-in range business, 50% of the dishwasher volume. In 1949, according to NEMA, appliance dealers sold 35.5% of water heaters;

Index of Saturation—January 1, 1957

	Number and Percentage of Wired Homes With	
AIR CONDITIONERS (room)	3,600,000	7.6
BED COVERINGS	6,261,000	13.2
BLENDERS	2,726,000	5.7
CLOCKS	42,600,000	89.8
COFFEE MAKERS (automatic)	18,425,000	38.9
DEHUMIDIFIERS	705,000	1.5
DISHWASHERS	2,201,000	4.6
DRYERS, CLOTHES (electric and gas)	5,625,000	11.9
FOOD WASTE DISPOSERS	3,118,000	6.6
FREEZERS	8,550,000	18.0
FRYPAN, SKILLET	9,900,000	20.9
HEATERS, PORTABLE (electric)	12,320,000	26.0
HEATING PADS	16,691,000	35.2
HOTPLATES	10,848,000	22.9
IRONERS	4,268,000	9.0
IRONS (standard)	42,750,000	90.2
STEAM IRONS	20,161,000	42.5
MIXERS	20,748,000	43.8
RADIO	47,700,000	96.2
RANGES (Standard)	13,780,000	29.1
RANGES (Built-in)	685,000	1.4
REFRIGERATORS	45,500,000	96.0
SANDWICH-WAFFLER (combinations)	15,990,000	33.7
SHAVERS	23,835,000	50.3
*TELEVISION	38,400,000	81.0
TOASTERS	36,538,000	77.1
VACUUM CLEANERS	31,600,000	66.7
WASHERS, ELECTRIC	41,175,000	86.8
WATER HEATERS	8,015,000	16.9

*NBC Estimate. Sources: "Electrical Merchandising."

in 1955 their share of the business has dropped to 21.9%. Builders and government agencies jumped their share from 3.6 to 12.9% in the same period.

Despite the retailer's problems, utilities reported to *Electrical Merchandising* that there were a few more of them than in 1955. Two hundred and six reported increases in the number of dealers serving their territories in six out of the country's nine main regions for an average gain of .01%. Moreover, even fewer utilities have any plans to merchandise appliances themselves this year. Of 253 reporting, 80 said they will merchandise (as compared with 91 out of 254 last year), 170 will not.

This year looks like another 1956, but on a slightly bigger scale. Competition is likely to be even rougher (and profits still tough to make). Almost sure to increase unit sales are dryers, built-in ranges, dishwashers, disposers, air conditioners, automatic washers. Likely to stay close to the 1956 level are refrigerators, standard ranges, water heaters, freezers. But, overall, a rising level of consumer income and a galloping growth in installment credit should keep consumers buying appliances and radio-TV at a clip that will raise total volume to $9-billion for the third record in a row.

Where the Appliances Were Bought

Percentage of Appliances, Radio-TV Shipments by Region, Compared with Number of Electric Customers

	Residential & Rural Electric Customers Jan. 1, 1957		1956 Shipments by Percent of U. S. Total								
	Number	% of U. S. Total	Washers (8 Mos.)	Ironers (8 Mos.)	Dryers (8 Mos.)	Refrigerators (9 Mos.)	Freezers (9 Mos.)	Ranges (9 Mos.)	Water Htrs. (9 Mos.)	Television (9 Mos.)	Radios (9 Mos.)
New England	3,019,000	6.37	6.08	3.45	4.08	5.47	2.32	7.25	5.02	6.27	7.49
Middle Atlantic	9,267,000	19.54	18.93	13.43	18.11	20.27	10.18	13.66	12.55	21.40	27.05
East North Central	9,862,000	20.80	21.15	26.58	32.65	21.77	19.80	19.93	18.43	19.44	21.47
West North Central	4,357,000	9.19	8.05	12.20	9.13	7.26	11.42	7.47	7.68	7.60	6.53
South Atlantic	6,349,000	13.39	13.71	5.61	7.23	14.95	18.71	21.68	32.43	14.04	10.64
East South Central	3,029,000	6.39	6.25	2.28	3.37	5.75	10.91	8.66	7.74	6.02	4.33
West South Central	4,409,000	9.30	9.84	7.89	5.57	9.54	12.82	5.22	2.19	9.76	6.82
Mountain	1,657,000	3.49	3.53	15.36	3.52	3.18	4.19	4.40	3.68	3.21	2.66
Pacific	5,466,000	11.53	12.46	13.20	16.34	11.81	9.65	11.73	10.28	12.26	13.01
Total	47,415,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table prepared by "Electrical Merchandising" on basis of figures compiled by EEI NEMA AHLMA & RETMA]

Capacity Additions Reported to Electrical World—Kw†

	1956	1957	1958	1959	After 1959
Hydro					
Power Companies	282,175	426,400	1,716,700	486,000	1,394,800
Municipal ,State and Power District Systems	154,000	84,200	599,000	591,000	2,705,300
Cooperatives	.....	.....	.....	.....	.....
Federal Agencies	620,333	787,500	689,250	482,500	6,139,500
Total	**1,056,508**	**1,298,100**	**3,004,950**	**1,559,500**	**10,239,600**
Steam					
Power Companies	5,042,875	6,609,375	12,040,250	9,769,450	8,218,000
Municipal, State and Power District Systems	598,825	876,375	1,558,800	1,178,000	1,097,000
Cooperatives	25,875	116,000	148,500	199,300	82,000
Federal Agencies	550,000	450,000	555,000	575,000	.....
Total	**6,217,575**	**8,051,750**	**14,302,550**	**11,721,750**	**9,397,000**
Internal Combustion					
Power Companies	7,370	3,285	5,000	.....	.....
Municipal, State and Power District Systems	21,805	77,080	29,500	15,650	78,850
Cooperatives	300	4,845	9,345	3,100	300
Federal Agencies	.....	.....	.....	.....	.....
Total	**29,475**	**85,210**	**43,845**	**18,750**	**79,150**
Total					
Power Companies	5,332,420	7,039,060	13,761,950	10,255,450	9,612,800
Municipal, State and Power District Systems	774,630	1,037,655	2,187,300	1,784,650	2,969,150
Cooperatives	26,175	120,845	157,845	202,400	82,300
Federal Agencies	1,170,333	1,237,500	1,244,250	1,057,500	6,139,500
Total	**7,303,558**	**9,435,060**	**17,351,345**	**13,300,000**	**19,715,750**

Source: "Electrical World" Surveys. † Maximum rated capability.

59,802 Mw of New Capacity Planned by Industry

New capacity additions planned by all segments of the industry have swelled to 59,802 Mw according to Electrical World's latest survey. This exceeds last year's figure by 16,802 Mw or 39%. It is significant that 40,000 Mw or two-thirds of this total will be added by the end of 1959 and almost exactly half in the two years 1958 and 1959.

Peak year for new capacity additions by all agencies will be 1958 when 79% of the projected 17,351,354 kw will be added by power companies.

Additions in 1956 were at a low ebb, largely due to the lull in orders placed in 1954. Total for the year was 7,303,558 kw of which 73% was added by the power companies and 16% was added by Federal agencies.

Prospects for 1957 are for a 29% increase in capacity additions over 1956, bringing the total to 9,435,000 kw. Over 74% of this will be added by power companies and 31% will be placed in the East North Central region.

Capacity additions recently reported to Electrical World are at maximum rated capability.

Details of this study follow on the next 13 pages. .....

New Capacity Additions Reported to Electrical World—Kw

NEW ENGLAND

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Power Companies								
Bangor Hydro Electric..	Hydro	39,087	1,600	.....	.....	.....	.....	.....
	Steam	11,500	.....	16,500	.....	.....	.....	16,500
	IC	6,000	.....	.....	.....	.....	.....	.....
	GT	12,000	.....	.....	.....	.....	.....	.....
	Total	68,587	1,600	16,500	.....	.....	.....	16,500
Boston Edison.....	Hydro	50	.....	140,000	.....	140,000	.....	280,000
	Steam	801,360	.....	.....	.....	.....	.....	.....
	Total	801,410	.....	140,000	.....	140,000	.....	280,000
Cambridge Electric Light	Steam	35,000	.....	.....	25,000	.....	.....	25,000
Central Maine Power..	Hydro	266,979	.....	.....	.....	.....	.....	.....
	Steam	197,000	.....	50,000	50,000	.....	.....	100,000
	IC	2,751	.....	.....	.....	.....	.....	.....
	GT	4,000	.....	.....	.....	.....	.....	.....
	Total	470,730	.....	50,000	50,000	.....	.....	100,000
Central Vermont Public Service	Hydro	41,257	500	.....	.....	.....	.....	.....
	Steam	4,500	.....	.....	.....	.....	.....	.....
	IC	2,500	.....	.....	.....	.....	.....	.....
	GT	18,000	.....	.....	.....	.....	.....	.....
	Total	66,257	500	.....	.....	.....	.....	.....
Citizens Utilities.....	Hydro	5,000	1,600	.....	.....	.....	.....	.....
	IC	6,980	.....	.....	.....	.....	.....	.....
	Total	11,980	1,600	.....	.....	.....	.....	.....
Connecticut L&P.....	Hydro	111,970	.....	.....	.....	.....	62,000	62,000
	Steam	548,000	106,000	.....	106,000	150,000	.....	256,000
	GT	24,000	.....	.....	.....	.....	.....	.....
	Total	683,970	106,000	.....	106,000	150,000	62,000	318,000
Connecticut Power.....	Hydro	9,000	.....	600	.....	.....	.....	600
	Steam	67,240	.....	.....	.....	.....	.....	.....
	Total	76,240	.....	600	.....	.....	.....	600
Fitchburg G&E Lt.....	Steam	32,625	.....	.....	.....	.....	20,000	20,000
Hartford Electric Light..	Steam	322,000	.....	.....	100,000	.....	.....	100,000
Lynn G & E.....	Steam	59,980	.....	.....	.....	.....	20,000	20,000
Montaup Electric.....	Steam	190,000	.....	.....	.....	.....	100,000	100,000
New England G.E.....	Steam	197,250	.....	.....	28,000	.....	.....	28,000
	IC	2,527	.....	.....	.....	.....	.....	.....
	Total	199,777	.....	.....	28,000	.....	.....	28,000
New England Electric System	Hydro	520,080	190,000	.....	140,000	.....	.....	140,000
	Steam	683,320	.....	.....	.....	.....	.....	.....
	IC	10,000	.....	.....	.....	.....	.....	.....
	Total	1,213,400	190,000	.....	140,000	.....	.....	140,000
Public Service of New Hampshire	Hydro	74,650	.....	.....	.....	.....	.....	.....
	Steam	213,250	.....	50,000	.....	.....	150,000	200,000
	IC	3,000	.....	.....	.....	.....	.....	.....
	Total	290,900	.....	50,000	.....	.....	150,000	200,000
United Illuminating....	Steam	338	4,800	82,000	.....	.....	.....	82,000
Western Massachusetts Electric	Hydro	99,875	.....	.....	.....	.....	.....	.....
	Steam	175,100	.....	100,000	.....	.....	.....	100,000
	Total	274,975	.....	100,000	.....	.....	.....	100,000
Total.....	**Hydro**	**1,167,948**	**193,700**	**140,600**	**140,000**	**140,000**	**62,000**	**482,600**
	Steam	**3,538,463**	**110,800**	**298,500**	**309,000**	**150,000**	**290,000**	**1,047,500**
	IC	**33,758**	.....	.....	.....	.....	.....	.....
	GT	**58,000**	.....	.....	.....	.....	.....	.....
	Total	**4,798,169**	**304,500**	**439,100**	**449,000**	**290,000**	**352,000**	**1,530,100**
Municipal, State and Power District Systems								
Holyoke, Mass.....	Hydro	2,330	.....	.....	.....	.....	.....	.....
	Steam	30,000	9,375	.....	15,000	.....	.....	15,000
	Total	32,330	9,375	.....	15,000	.....	.....	15,000
Taunton, Mass.....	Steam	34,000	.....	16,500	.....	.....	.....	16,500
Total.....	**Hydro**	**2,330**	.....	.....	.....	.....	.....	.....
	Steam	**64,000**	**9,375**	**16,500**	**15,000**	.....	.....	**31,500**
	Total	**66,330**	**9,375**	**16,500**	**15,000**	.....	.....	**31,500**
New England Total All Agencies	**Hydro**	**1,170,278**	**193,700**	**140,600**	**140,000**	**140,000**	**62,000**	**482,600**
	Steam	**3,602,463**	**120,175**	**315,000**	**324,000**	**150,000**	**290,000**	**1,079,000**
	IC	**33,758**	.....	.....	.....	.....	.....	.....
	GT	**58,000**	.....	.....	.....	.....	.....	.....
	Total	**4,864,499**	**313,875**	**455,600**	**464,000**	**290,000**	**352,000**	**1,561,600**

MIDDLE ATLANTIC

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Power Companies								
Atlantic City Electric	Steam	318,000	.....	23,000	79,000	.....	.....	102,000
Central Hudson G & E.	Hydro	47,020	.....	.....	.....	.....	.....	.....
	Steam	132,000	.....	.....	.....	138,000	.....	138,000
	Total	179,020	.....	.....	.....	138,000	.....	138,000
Consolidated Edison	Steam	3,736,000	.....	.....	350,000	350,000	220,000	920,000
Duquesne Light	Steam	1,139,000	150,000	60,000	.....	170,000	170,000	400,000
Jersey Central P & L	Steam	360,224	.....	.....	122,500	.....	.....	122,500
Long Island Lighting	Steam	773,850	175,000	.....	175,000	.....	.....	175,000
Metropolitan Edison	Hydro	20,620	.....	.....	.....	.....	.....	.....
	Steam	481,500	.....	.....	165,000	.....	.....	165,000
	Total	502,120	.....	.....	165,000	.....	.....	165,000
New York State E & G.	Hydro	46,965	6,100	.....	.....	.....	.....	.....
	Steam	602,750	.....	.....	154,000	.....	.....	154,000
	IC	2,968	.....	.....	.....	.....	.....	.....
	Total	652,683	6,100	.....	154,000	.....	.....	154,000
Niagara Mohawk Power	Hydro	773,800	.....	117,000	18,000	.....	.....	135,000
	Steam	1,865,000	.....	204,000	204,000	408,000	.....	816,000
	Total	2,638,800	.....	321,000	222,000	408,000	.....	951,000
Pennsylvania Electric	Hydro	52,700	.....	.....	.....	.....	.....	.....
	Steam	746,862	.....	137,500	.....	180,000	.....	317,500
	Total	799,562	.....	137,500	.....	180,000	.....	317,500
Pennsylvania Power	Steam	155,000	.....	.....	90,000	.....	.....	90,000
Pennsylvania P & L	Hydro	151,600	.....	.....	.....	.....	.....	.....
	Steam	1,204,450	160,000	.....	.....	.....	300,000	300,000
	Total	1,356,050	160,000	.....	.....	.....	300,000	300,000
Philadelphia Electric	Hydro	252,000	.....	.....	.....	.....	.....	.....
	Steam	2,096,250	44,000	.....	175,000	325,000	325,000	825,000
	Total	2,348,250	44,000	.....	175,000	325,000	325,000	825,000
Public Service E & G.	Steam	2,104,300	.....	450,000	290,000	290,000	300,000	1,330,000
Rochester G & E	Hydro	48,440	.....	.....	.....	.....	.....	.....
	Steam	293,100	.....	83,500	.....	100,000	.....	183,500
	Total	341,540	.....	83,500	.....	100,000	.....	183,500
Rockland L & P	Hydro	43,750	18,000	.....	.....	.....	.....	.....
	Steam	120,275	.....	.....	.....	.....	70,000	70,000
	Total	164,025	18,000	.....	.....	.....	70,000	70,000
West Penn Power	Hydro	52,000	.....	.....	.....	.....	.....	.....
	Steam	887,000	.....	.....	165,000	165,000	.....	330,000
	Total	939,000	.....	.....	165,000	165,000	.....	330,000
Total	**Hydro**	**1,488,895**	**24,100**	**117,000**	**18,000**	.....	.....	**135,000**
	Steam	**17,015,561**	**529,000**	**958,000**	**1,969,500**	**2,126,000**	**1,385,000**	**6,438,500**
	IC	**2,968**	.....	.....	.....	.....	.....	.....
	Total	**18,507,424**	**553,100**	**1,075,000**	**1,987,500**	**2,126,000**	**1,385,000**	**6,573,500**
Municipal, State and Power District Systems								
Chambersburg, Pa	Steam	15,000	5,000	.....	.....	.....	.....	.....
Grove City, Pa	IC	6,045	1,250	.....	.....	.....	.....	.....
Hatfield, Pa	IC	1,685	675	.....	.....	.....	.....	.....
N. Y. State Power Authority	Hydro	.....	.....	.....	456,000	456,000	.....	912,000
Rockville Center, N. Y.	IC	15,420	.....	4,000	.....	.....	.....	4,000
Quakertown, Pa	Steam	6,000	.....	.....	.....	.....	.....	.....
	IC	1,100	.....	1,050	.....	.....	.....	1,050
	Total	7,100	.....	1,050	.....	.....	.....	1,050
Vineland, N. J.	Steam	36,000	.....	.....	.....	.....	20,000	20,000
Total	**Hydro**	.....	.....	.....	**456,000**	**456,000**	.....	**912,000**
	Steam	**57,000**	**5,000**	.....	.....	.....	**20,000**	**20,000**
	IC	**24,250**	**1,925**	**5,050**	.....	.....	.....	**5,050**
	Total	**81,250**	**6,925**	**5,050**	**456,000**	**456,000**	**20,000**	**937,050**
Middle Atlantic	**Hydro**	**1,488,895**	**24,100**	**117,000**	**474,000**	**456,000**	.....	**1,047,000**
Total All Agencies	**Steam**	**17,072,561**	**534,000**	**958,000**	**1,969,500**	**2,126,000**	**1,405,000**	**6,458,500**
	IC	**27,218**	**1,925**	**5,050**	.....	.....	.....	**5,050**
	Total	**18,588,674**	**560,025**	**1,080,050**	**2,443,500**	**2,582,000**	**1,405,000**	**7,510,550**

EAST NORTH CENTRAL

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Power Companies								
Central Illinois E & G	Hydro	1,200	.....	.....	.....	.....	.....	.....
	Steam	161,750	.....	.....	.....	.....	40,000	40,000
	IC	750	.....	.....	.....	.....	.....	.....
	Total	163,700	.....	.....	.....	.....	40,000	40,000

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
East North Central (continued)								
Central Illinois Light	Steam	226,400	.....	100,000	.....	.....	125,000	225,000
Central Illinois P. S.	Steam	380,000	.....	100,000	.....	.....	.....	100,000
Cincinnati G & E	Steam	895,000	.....	172,000	.....	172,000	.....	344,000
Cleveland Electric Illuminating	Steam	1,426,400	240,000	.....	240,000	250,000	.....	490,000
Columbus & Southern Ohio	Steam	540,000	.....	125,000	125,000	.....	125,000	375,000
	IC	250	.....	.....	.....	.....	.....	.....
	Total	540,250	.....	125,000	125,000	.....	125,000	375,000
Commonwealth Edison	Hydro	6,865	.....	.....	.....	.....	.....	.....
	Steam	3,800,500	.....	295,000	815,000	305,000	180,000	1,595,000
	IC	1,000	.....	.....	.....	.....	.....	.....
	Total	3,808,365	.....	295,000	815,000	305,000	180,000	1,595,000
Consumers Power	Hydro	150,940	.....	.....	.....	.....	.....	.....
	Steam	1,562,600	156,000	156,000	156,000	238,000	.....	550,000
	IC	6,498	.....	.....	.....	.....	.....	.....
	Total	1,720,038	156,000	156,000	156,000	238,000	.....	550,000
Dayton P & L	Steam	510,000	.....	130,000	130,000	.....	.....	260,000
Detroit Edison	Hydro	7,850	.....	.....	.....	.....	.....	.....
	Steam	2,585,000	260,000	580,000	325,000	325,000	150,000	1,380,000
	Total	2,592,850	260,000	580,000	325,000	325,000	150,000	1,380,000
Illinois Power	Hydro	1,500	.....	.....	.....	.....	.....	.....
	Steam	800,500	100,000	.....	.....	200,000	.....	200,000
	IC	2,000	.....	.....	.....	.....	.....	.....
	Total	804,000	100,000	.....	.....	200,000	.....	200,000
Indiana-Kentucky Electric	Steam	1,080,000	180,000	.....	.....	.....	.....	.....
Indiana Michigan Electric	Hydro	23,504	.....	.....	.....	.....	.....	.....
	Steam	823,250	.....	.....	450,000	.....	.....	450,000
	Total	846,754	.....	.....	450,000	.....	.....	450,000
Indianapolis P & L	Steam	596,000	105,000	.....	105,000	.....	105,000	210,000
Lake Superior District Power	Hydro	11,968	.....	.....	.....	.....	.....	.....
	Steam	55,000	.....	12,000	.....	.....	.....	12,000
	IC	4,000	.....	.....	.....	.....	.....	.....
	Total	70,968	.....	12,000	.....	.....	.....	12,000
Madison G & E	Steam	85,000	.....	44,000	.....	.....	.....	44,000
Mt. Carmel Public Utility	Steam	14,500	.....	9,375	.....	.....	.....	9,375
Northern Indiana Public Service	Steam	138,100	138,100	.....	.....	276,200	.....	276,200
Northern States Power	Hydro	149,130	25,375	.....	4,200	.....	.....	4,200
	Steam	54,500	.....	.....	.....	.....	.....	.....
	IC	3,100	.....	.....	.....	.....	.....	.....
	Total	206,730	25,375	.....	4,200	.....	.....	4,200
Ohio Edison	Hydro	1,950	.....	.....	.....	.....	.....	.....
	Steam	1,450,350	.....	90,000	170,000	170,000	340,000	770,000
	Total	1,452,300	.....	90,000	170,000	170,000	340,000	770,000
Ohio Edison & Pennsylvania Power	Hydro	1,950	.....	.....	.....	.....	.....	.....
	Steam	1,605,350	.....	90,000	260,000	170,000	340,000	860,000
	Total	1,607,300	.....	90,000	260,000	170,000	340,000	860,000
Ohio Power	Hydro	3,000	.....	.....	.....	.....	.....	.....
	Steam	964,000	.....	570,000	.....	.....	.....	570,000
	Total	967,000	.....	570,000	.....	.....	.....	570,000
Public Service Company of Indiana	Hydro	3,200	.....	.....	.....	.....	.....	.....
	Steam	991,000	125,000	150,000	150,000	150,000	.....	450,000
	Total	994,200	125,000	150,000	150,000	150,000	.....	450,000
Toledo Edison	Hydro	5,000	.....	.....	.....	.....	.....	.....
	Steam	454,000	.....	.....	135,000	.....	.....	135,000
	Total	459,000	.....	.....	135,000	.....	.....	135,000
Wisconsin Electric Power	Hydro	415	.....	.....	.....	.....	.....	.....
	Steam	1,194,500	.....	120,000	.....	.....	250,000	370,000
	Total	1,194,915	.....	120,000	.....	.....	250,000	370,000
Wisconsin Hydro Electric	Hydro	4,402	.....	.....	.....	1,000	.....	1,000
	Steam	.....	.....	.....	.....	10,000	.....	10,000
	IC	5,900	.....	.....	.....	.....	.....	.....
	Total	10,302	.....	.....	.....	11,000	.....	11,000
Wisconsin P & L	Hydro	42,200	.....	.....	.....	.....	.....	.....
	Steam	327,200	.....	.....	.....	100,000	100,000	200,000
	Total	369,400	.....	.....	.....	100,000	100,000	200,000
Wisconsin Public Service	Hydro	63,296	.....	.....	.....	.....	.....	.....
	Steam	271,750	.....	.....	75,000	.....	.....	75,000
	IC	3,000	.....	.....	.....	.....	.....	.....
	Total	338,046	.....	.....	75,000	.....	.....	75,000
Total	**Hydro**	**478,370**	**25,375**	.....	**4,200**	**1,000**	.....	**5,200**
	Steam	**22,992,650**	**1,304,100**	**2,743,375**	**3,136,000**	**2,366,200**	**1,755,000**	**10,000,575**
	IC	**26,498**	.....	.....	.....	.....	.....	.....
	Total	**23,497,518**	**1,329,475**	**2,743,375**	**3,140,200**	**2,367,200**	**1,755,000**	**10,005,775**
Municipal, State and Power District Systems								
Celina, Ohio	Steam	5,000	.....	.....	.....	6,000	.....	6,000
Cleveland, Ohio	Steam	137,500	.....	.....	.....	.....	.....	.....
	IC	1,500	1,500	.....	.....	.....	40,000	40,000
	Total	139,000	.....	.....	.....	.....	40,000	40,000

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
East North Central (continued)								
Coldwater, Mich.	Steam	5,500	.....	.....	.....	.....	6,000	6,000
	IC	2,000	.....	.....	.....	.....	.....	.....
	Total	7,500	.....	.....	.....	.....	6,000	6,000
Columbus, Ohio	Steam	460,000	15,625	.....	.....	.....	.....	.....
Detroit, Mich.	Steam	120,000	.....	.....	40,000	.....	.....	40,000
Dover, Ohio	Steam	15,750	9,375	.....	.....	.....	10,000	10,000
East Palestine, Ohio	Steam	4,000	6,250	.....	.....	.....	.....	.....
Escanaba, Mich.	Steam	.....	.....	.....	25,000	.....	.....	25,000
Fairfield, Ill.	Steam	9,375	6,250	.....	.....	.....	.....	.....
Geneseo, Ill.	IC	3,331	.....	2,000	.....	.....	.....	2,000
Hamilton, Ohio	Steam	33,500	.....	.....	22,000	.....	.....	22,000
Holland, Mich.	Steam	31,500	.....	.....	.....	22,000	.....	22,000
Kalamazoo, Mich.	Steam	20,000	9,375	.....	.....	.....	.....	.....
Lansing, Mich.	Hydro	1,200	.....	.....	.....	.....	.....	.....
	Steam	180,650	.....	.....	44,000	.....	.....	44,000
	Total	181,850	.....	.....	44,000	.....	.....	44,000
Logansport, Ind.	Steam	13,000	.....	16,500	.....	.....	.....	16,500
Manitowoc, Wis.	Steam	52,000	22,000	.....	.....	.....	22,000	22,000
Menasha, Wis.	Steam	15,500	9,375	.....	.....	.....	.....	.....
	IC	1,600	.....	.....	.....	.....	.....	.....
	Total	17,100	9,375	.....	.....	.....	.....	.....
Mt. Carmel, Ill.	Steam	13,000	.....	7,500	.....	.....	.....	7,500
Napoleun, Ohio	Steam	5,000	.....	6,000	.....	.....	10,000	16,000
Norwalk, Ohio	Steam	7,000	.....	7,500	.....	.....	.....	7,500
Orrville, Ohio	Steam	16,500	.....	.....	.....	15,000	.....	15,000
Painesville, Ohio	Steam	21,500	9,375	.....	.....	.....	.....	.....
Peru, Ind.	Steam	19,500	.....	22 000	.....	.....	.....	22,000
Petroskey, Mich.	Hydro	870	.....	.....	.....	.....	.....	.....
	IC	4,250	.....	1,450	.....	.....	2,000	3,450
	Total	5,120	.....	1,450	.....	.....	2,000	3,450
Reading, Ohio	Steam	5,500	.....	.....	7,500	.....	.....	7,500
Rochelle, Ill.	IC	8,640	2,500	4,000	.....	.....	.....	4,000
Sebewaing, Mich.	IC	3,017	.....	.....	.....	.....	2,500	2,500
South Haven, Mich.	Steam	10,000	.....	7,500	.....	.....	.....	7,500
Springfield, Ill.	Steam	80,000	.....	.....	.....	35,000	35,000	70,000
St. Mary's, Ohio	Steam	6,750	.....	7,500	.....	.....	.....	7,500
Tipp City, Ohio	Steam	1,500	.....	.....	.....	.....	.....	.....
	IC	2,480	.....	1,500	.....	.....	.....	1,500
	Total	3,980	.....	1,500	.....	.....	.....	1,500
Traverse City, Mich.	Hydro	1,150	.....	.....	.....	.....	.....	.....
	Steam	15,000	.....	.....	.....	.....	12,500	12,500
	Total	16,150	.....	.....	.....	.....	12,500	12,500
Washington, Ind.	Steam	10,000	10,000	.....	.....	.....	.....	.....
Winnetka, Ill.	Steam	15,500	.....	.....	.....	.....	12,500	12,500
Woodstock, Ill.	Steam	14,000	.....	10,000	.....	.....	.....	10,000
	IC	2,600	2,600	.....	.....	.....	.....	.....
	Total	16,600	.....	.....	.....	.....	.....	.....
Wyandotte, Mich.	Steam	23,500	.....	.....	22,500	.....	.....	22,500
Zeeland, Mich.	IC	4,486	.....	2,000	.....	.....	.....	2,000
Total	**Hydro**	**3,220**	.....	.....	.....	.....	.....	.....
	Steam	**1,367,525**	**97,625**	**84,500**	**161,000**	**78,000**	**108,000**	**431,500**
	IC	**33,904**	**6,600**	**10,950**	.....	.....	**44,500**	**55,450**
	Total	**1,404,649**	**104,225**	**95,450**	**161,000**	**78,000**	**152,500**	**486,950**
Cooperatives								
Dairyland Power	Hydro	21,600	.....	.....	.....	.....	.....	.....
	Steam	117,500	.....	50,000	.....	75,000	.....	125,000
	IC	13,900	.....	.....	.....	.....	.....	.....
	Total	153,000	.....	50,000	.....	75,000	.....	125,000
East Kentucky Rural Electric	Steam	40,000	.....	66,000	.....	.....	.....	66,000
Warrior River Electric	Steam	.....	.....	.....	66,000	66,000	.....	132,000
Washington Island Electric	IC	.....	.....	.....	.....	.....	300	300
Western Michigan Electric	IC	.....	.....	.....	2,000	.....	.....	2,000
Wolverine Electric	IC	18,397	.....	2,500	5,000	.....	.....	7,500
Total	**Hydro**	**21,600**	.....	.....	.....	.....	.....	.....
	Steam	**157,500**	.....	**116,000**	**66,000**	**141,000**	.....	**323,000**
	IC	**32,297**	.....	**2,500**	**7,000**	.....	**300**	**9,800**
	Total	**211,397**	.....	**118,500**	**73,000**	**141,000**	**300**	**332,800**

East North Central (continued)

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Federal Agencies								
Corps of Engineers	Hydro	18,400	.....	.....	.....	.....	.....	.....
East North Central	**Hydro**	**521,590**	**25,375**	.....	**4,200**	**1,000**	.....	**5,200**
Total All Agencies	**Steam**	**24,517,675**	**1,401,725**	**2,943,875**	**3,363,000**	**2,585,200**	**1,863,000**	**10,755,075**
	IC	**92,699**	**6,600**	**13,450**	**7,000**	.....	**44,800**	**65,250**
	Total	**25,131,964**	**1,433,700**	**2,957,325**	**3,374,200**	**2,586,200**	**1,907,800**	**10,825,525**

WEST NORTH CENTRAL

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Power Companies								
Black Hills P & L	Hydro	1,346	.....	.....	.....	.....	.....	.....
	Steam	80,500	16,500	.....	.....	22,500	.....	22,500
	IC	8,513	.....	.....	.....	.....	.....	.....
	Total	90,359	16,500	.....	.....	22,500	.....	22,500
Central Kansas Power	Steam	36,250	7,500	7,500	.....	.....	.....	7,500
	IC	5,600	.....	.....	.....	.....	.....	.....
	Total	41,850	7,500	7,500	.....	.....	.....	7,500
Empire District Electric	Hydro	19,000	.....	.....	.....	.....	.....	.....
	Steam	144,500	.....	2,500	.....	.....	66,000	68,500
	Total	163,500	.....	2,500	.....	.....	66,000	68,500
Interstate Power	Hydro	4,922	.....	.....	.....	.....	.....	.....
	Steam	163,375	27,625	33,000	.....	44,000	44,000	121,000
	IC	6,035	2,000	.....	.....	.....	.....	.....
	Total	174,332	29,625	33,000	.....	44,000	44,000	121,000
Iowa Electric L & P	Hydro	4,053	.....	.....	.....	.....	.....	.....
	Steam	240,625	.....	.....	44,000	.....	.....	44,000
	IC	49,687	1,000	.....	.....	.....	.....	.....
	Total	294,365	1,000	.....	44,000	.....	.....	44,000
Iowa Illinois G & E	Hydro	4,000	.....	.....	.....	.....	.....	.....
	Steam	240,000	.....	.....	.....	.....	100,000	100,000
	IC	1,148	.....	.....	.....	.....	.....	.....
	Total	245,148	.....	.....	.....	.....	100,000	100,000
Iowa P & L	Hydro	400	.....	.....	.....	.....	.....	.....
	Steam	269,750	.....	.....	90,000	.....	.....	90,000
	IC	10,348	.....	.....	.....	.....	.....	.....
	Total	280,498	.....	.....	90,000	.....	.....	90,000
Iowa Public Service	Hydro	2,051	.....	.....	.....	.....	.....	.....
	Steam	163,800	.....	.....	51,000	.....	.....	51,000
	IC	29,295	4,070	.....	.....	.....	.....	.....
	Total	195,146	4,070	.....	51,000	.....	.....	51,000
Iowa Southern Utilities	Steam	74,550	.....	22,000	.....	.....	.....	22,000
	IC	5,000	.....	.....	.....	.....	.....	.....
	Total	79,550	.....	22,000	.....	.....	.....	22,000
Kansas City P & L	Steam	685,750	.....	.....	175,000	.....	175,000	350,000
Kansas G & E	Steam	423,000	112,000	.....	.....	112,000	.....	112,000
Kansas P & L	Hydro	1,060	.....	.....	.....	.....	.....	.....
	Steam	336,250	.....	92,000	.....	125,000	.....	217,000
	IC	2,958	.....	.....	.....	.....	.....	.....
	Total	340,268	.....	92,000	.....	125,000	.....	217,000
Minnesota P & L	Hydro	106,940	.....	.....	.....	.....	.....	.....
	Steam	240,500	.....	.....	.....	65,000	65,000	130,000
	Total	347,440	.....	.....	.....	65,000	65,000	130,000
Missouri Public Service	Hydro	1,600	.....	.....	.....	.....	.....	.....
	Steam	49,000	.....	22,000	.....	.....	.....	22,000
	IC	4,413	.....	.....	.....	.....	.....	.....
	Total	55,013	.....	22,000	.....	.....	.....	22,000
Montana-Dakota Utilities	Steam	86,600	.....	.....	44,000	.....	.....	44,000
	IC	17,750	.....	.....	.....	.....	.....	.....
	Total	104,350	.....	.....	44,000	.....	.....	44,000
Northern States Power	Hydro	39,070	.....	.....	.....	.....	.....	.....
	Steam	1,062,300	117,000	.....	.....	156,000	156,000	312,000
	IC	30,415	.....	.....	.....	.....	.....	.....
	Total	1,131,785	117,000	.....	.....	156,000	156,000	312,000
Otter Tail Power	Hydro	5,745	.....	.....	.....	.....	.....	.....
	Steam	94,000	.....	.....	53,500	.....	.....	53,500
	IC	23,725	.....	.....	.....	.....	.....	.....
	Total	123,470	.....	.....	53,500	.....	.....	53,500
St. Joseph L & P	Steam	66,840	2,500	25,000	.....	.....	33,000	58,000
	IC	2,205	.....	.....	.....	.....	.....	.....
	Total	69,045	2,500	25,000	.....	.....	33,000	58,000
Union Electric Co of Missouri	Hydro	293,600	.....	.....	.....	.....	.....	.....
	Steam	1,230,000	.....	.....	283,000	.....	336,000	619,000
	Total	1,523,600	.....	.....	283,000	.....	336,000	619,000
Western Light & Telephone	Steam	60,000	.....	19,000	.....	.....	19,000	38,000
	IC	20,000	.....	.....	.....	.....	.....	.....
	Total	80,000	.....	19,000	.....	.....	19,000	38,000
Total	**Hydro**	**483,787**	.....	.....	.....	.....	.....	.....
	Steam	**5,747,590**	**283,125**	**223,000**	**740,500**	**524,500**	**994,000**	**2,482,000**
	IC	**217,092**	**7,070**	.....	.....	.....	.....	.....
	Total	**6,448,469**	**290,195**	**223,000**	**740,500**	**524,500**	**994,000**	**2,482,000**

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
West North Central (continued)								
Municipal, State and Power District Systems								
Aitkin, Minn.	IC	3,000	.....	.....	.....	.....	1,200	1,200
Algona, Iowa	IC	6,204	.....	.....	.....	3,000	.....	3,000
Ames, Iowa	Steam	15,500	.....	.....	12,650	.....	.....	12,650
	IC	1,000	.....	.....	.....	.....	.....	.....
	Total	16,500	.....	.....	12,650	.....	.....	12,650
Atlantic, Iowa	Steam	6,250	.....	5,000	.....	.....	.....	5,000
Barnesville, Minn.	IC	.....	.....	450	.....	.....	750	1,200
Blair, Neb.	IC	2,620	.....	2,500	.....	.....	.....	2,500
Blooming Prairie, Minn.	IC	2,360	1,400	.....	.....	.....	.....	.....
Cascade, Iowa	IC	.....	.....	580	.....	.....	.....	580
Chanute, Kan.	Steam	8,000	.....	9,375	.....	.....	.....	9,375
Chillicothe, Mo.	Steam	9,000	.....	6,000	.....	.....	.....	6,000
Coffeyville, Kan.	Steam	21,500	18,750	.....	.....	.....	.....	.....
Columbia, Mo.	Steam	18,500	.....	16,500	.....	.....	.....	16,500
Consumers Public Power District	Hydro	9,115	.....	.....	.....	.....	.....	.....
	Steam	25,125	.....	.....	.....	.....	75,000	75,000
	IC	16,821	.....	.....	.....	.....	.....	.....
	Total	51,061	.....	.....	.....	.....	75,000	75,000
Curtis, Neb.	IC	1,682	900	.....	.....	.....	.....	.....
Elk River, Minn.	IC	.....	.....	.....	2,000	.....	.....	2,000
Fairbury, Neb.	Hydro	250	.....	.....	.....	.....	.....	.....
	Steam	8,500	.....	.....	.....	.....	7,500	7,500
	Total	8,750	.....	.....	.....	.....	7,500	7,500
Fairmount, Minn.	Steam	12,000	.....	.....	.....	10,000	20,000	30,000
Fremont, Neb.	Steam	21,000	.....	16,500	.....	.....	33,000	49,500
Fulton, Mo.	Steam	.....	.....	.....	6,000	.....	.....	6,000
Grand Island, Neb.	Steam	10,000	16,500	.....	.....	.....	.....	.....
Hastings, Neb.	Steam	17,500	.....	16,500	.....	.....	.....	16,500
Horton, Kan.	IC	2,065	.....	.....	1,000	.....	800	1,800
Independence, Mo.	Steam	7,500	6,250	.....	44,000	.....	.....	44,000
Iola, Kan.	Steam	7,000	.....	5,000	.....	.....	7,500	12,500
Johnson, Kan.	IC	787	.....	.....	.....	.....	450	450
Kansas City, Kan.	Steam	169,000	.....	40,000	.....	.....	66,000	106,000
Kennett, Mo.	IC	7,560	.....	.....	5,000	.....	.....	5,000
Le Sueur, Minn.	IC	4,193	400	.....	.....	.....	.....	.....
Loup River Public Power District	Hydro	47,738	.....	.....	.....	.....	.....	.....
	Steam	120,000	.....	.....	.....	.....	100,000	100,000
	IC	3,300	.....	.....	.....	.....	.....	.....
	Total	171,038	.....	.....	.....	.....	100,000	100,000
Madison, Minn.	Steam	2,300	.....	2,500	.....	.....	.....	2,500
	IC	1,100	.....	.....	.....	.....	.....	.....
	Total	3,400	.....	2,500	.....	.....	.....	2,500
Marshall, Mo.	Steam	8,000	.....	7,500	.....	.....	.....	7,500
Mazippa, Minn.	IC	1,080	560	.....	.....	.....	.....	.....
McPherson, Kan.	Steam	27,000	11,500	.....	.....	25,000	.....	25,000
	IC	1,000	.....	.....	.....	.....	.....	.....
	Total	28,000	11,500	.....	.....	25,000	.....	25,000
Nebraska City, Neb.	Steam	2,500	.....	.....	.....	.....	2,500	2,500
	IC	5,500	.....	3,100	.....	.....	.....	3,100
	Total	8,000	.....	3,100	.....	.....	2,500	5,600
Nebraska Public Power System	Hydro	129,601	.....	.....	.....	.....	.....	.....
	Steam	146,500	.....	.....	100,000	.....	.....	100,000
	IC	2,976	.....	.....	.....	.....	.....	.....
	Total	279,077	.....	.....	100,000	.....	.....	100,000
Omaha Public Power District	Steam	264,000	.....	100,000	.....	100,000	.....	200,000
Owatonna, Minn.	Steam	8,500	.....	6,000	.....	.....	.....	6,000
Schuyler, Neb.	Steam	4,000	.....	4,000	.....	.....	.....	4,000
Springfield, Mo.	Steam	23,900	.....	44,000	.....	.....	.....	44,000
Stanberry, Mo.	IC	.....	.....	300	.....	.....	.....	300
Stratton, Neb.	IC	750	750	.....	.....	.....	.....	.....
Sumner, Iowa	IC	3,035	1,250	.....	.....	.....	1,500	1,500
Waverly, Iowa	Hydro	495	.....	.....	.....	.....	.....	.....
	IC	5,445	.....	3,000	.....	.....	.....	3,000
	Total	5,940	.....	3,000	.....	.....	.....	3,000

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
West North Central (continued)								
Wayne, Neb.	IC	5,000	2,000	.....	.....	.....	3,000	3,000
Wellington, Kan.	Steam	7,500	9,375	.....	.....	.....	.....	.....
Wells, Minn.	IC	3,891	.....	1,500	.....	.....	.....	1,500
Willmar, Minn.	Steam	7,750	9,375	.....	.....	.....	.....	.....
Winfield, Kan.	Steam	6,500	.....	10,000	.....	.....	.....	10,000
Total	**Hydro**	**187,199**	.....	.....	.....	.....	.....	.....
	Steam	**984,825**	**71,750**	**288,875**	**162,650**	**135,000**	**311,500**	**898,025**
	IC	**81,869**	**7,260**	**11,430**	**8,000**	**3,000**	**7,700**	**30,130**
	Total	**1,253,893**	**79,010**	**300,305**	**170,650**	**138,000**	**319,200**	**928,155**
Cooperatives								
Central Iowa Power	Steam	44,000	.....	.....	44,000	.....	.....	44,000
Central Kansas Electric	IC	10,520	.....	.....	.....	3,100	.....	3,100
Corn Belt Electric	Steam	46,500	.....	.....	.....	33,000	.....	33,000
	IC	24,100	.....	.....	.....	.....	.....	.....
	Total	70,600	.....	.....	.....	33,000	.....	33,000
East River Electric Power	Steam	.....	.....	.....	22,000	.....	.....	22,000
Minnesota Power	Hydro	600	.....	.....	.....	.....	.....	.....
	Steam	25,000	.....	.....	.....	.....	50,000	50,000
	IC	20,000	.....	.....	.....	.....	.....	.....
	Total	45,600	.....	.....	.....	.....	50,000	50,000
Northeast Missouri Electric Power	Steam	15,000	.....	.....	.....	.....	10,000	10,000
	IC	7,440	.....	.....	.....	.....	.....	.....
	Total	22,440	.....	.....	.....	.....	10,000	10,000
Rural Coop. Power Ass'n	Steam	27,000	.....	.....	.....	.....	22,000	22,000
	IC	20,670	.....	.....	.....	.....	.....	.....
	Total	47,670	.....	.....	.....	.....	22,000	22,000
Rushmore G&T	Steam	26,500	16,500	.....	.....	.....	.....	.....
SW Federated Power	Steam	1,500	9,375	.....	.....	.....	.....	.....
	IC	8,196	.....	.....	.....	.....	.....	.....
	Total	9,696	.....	.....	.....	.....	.....	.....
Wheatland Electric	IC	14,087	300	2,345	2,345	.....	.....	4,690
Total	**Hydro**	**600**	.....	.....	.....	.....	.....	.....
	Steam	**185,500**	**25,875**	.....	**66,000**	**33,000**	**82,000**	**181,000**
	IC	**105,013**	**300**	**2,345**	**2,345**	**3,100**	.....	**7,790**
	Total	**291,113**	**26,175**	**2,345**	**68,345**	**36,100**	**82,000**	**188,790**
Federal Agencies								
Corps of Engineers	Hydro	626,666	33,333	.....	.....	.....	755,000	755,000
Bureau of Reclamation	Hydro	1,200	.....	.....	.....	.....	184,400	184,400
Total	**Hydro**	**627,866**	**33,333**	.....	.....	.....	**939,400**	**939,400**
	Total	**627,866**	**33,333**	.....	.....	.....	**939,400**	**939,400**
West North Central	**Hydro**	**1,299,452**	**33,333**	.....	.....	.....	**939,400**	**939,400**
Total All Agencies	**Steam**	**6,917,915**	**380,750**	**511,875**	**969,150**	**692,500**	**1,387,500**	**3,561,025**
	IC	**403,974**	**14,630**	**13,775**	**10,345**	**6,100**	**7,700**	**37,920**
	Total	**8,621,341**	**428,713**	**525,650**	**979,495**	**698,600**	**2,334,600**	**4,538,345**

SOUTH ATLANTIC

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Power Companies								
Appalachian Electric Power	Hydro	120,899	.....	.....	.....	.....	.....	.....
	Steam	1,179,252	225,000	.....	450,000	.....	.....	450,000
	Total	1,300,151	225,000	.....	450,000	.....	.....	450,000
Baltimore G & E	Steam	955,500	125,000	.....	.....	125,000	.....	125,000
Carolina P & L	Hydro	205,100	.....	.....	.....	.....	.....	.....
	Steam	709,500	140,000	.....	175,000	.....	.....	175,000
	Total	914,600	140,000	.....	175,000	.....	.....	175,000
Delaware P & L	Steam	223,600	.....	125,000	.....	75,000	.....	200,000
Duke Power	Hydro	497,033	.....	.....	.....	.....	.....	.....
	Steam	1,839,000	.....	330,000	165,000	275,000	275,000	1,045,000
	IC	500	.....	.....	.....	.....	.....	.....
	Total	2,336,533	.....	330,000	165,000	275,000	275,000	1,045,000
Florida Power	Hydro	12,493	.....	.....	.....	.....	.....	.....
	Steam	526,000	70,000	.....	190,000	120,000	.....	310,000
	IC	3,328	.....	.....	.....	.....	.....	.....
	Total	541,821	70,000	.....	190,000	120,000	.....	310,000
Florida P & L	Steam	992,000	100,000	160,000	320,000	160,000	.....	640,000
	IC	10,000	.....	.....	.....	.....	.....	.....
	Total	1,002,000	100,000	160,000	320,000	160,000	.....	640,000
Florida Public Utilities	Hydro	170	.....	.....	.....	.....	.....	.....
	Steam	7,920	.....	.....	.....	.....	.....	.....
	IC	.....	.....	2,285	.....	.....	.....	2,285
	Total	8,090	.....	2,285	.....	.....	.....	2,285
Georgia Power	Hydro	360,930	5,000	.....	.....	60,000	.....	60,000
	Steam	1,089,000	.....	125,000	125,000	75,000	125,000	450,000
	Total	1,449,930	5,000	125,000	125,000	135,000	125,000	510,000
Gulf Power	Steam	155,000	.....	.....	.....	75,000	.....	75,000

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
South Atlantic (cotinnued)								
Ohio Power	Steam	400,000	.....	.....	675,000	450,000	.....	1,125,000
Potomac Edison	Hydro	12,150	.....	.....	.....	.....	.....	.....
	Steam	286,300	.....	.....	75,000	.....	.....	75,000
	Total	298,450	.....	.....	75,000	.....	.....	75,000
Potomac Electric Power	Steam	870,000	103,000	103,000	.....	175,000	175,000	453,000
Savannah Electric & Power	Steam	105,500	40,000	.....	50,000	.....	.....	50,000
	Total	105,500	40,000	.....	50,000	.....	.....	50,000
South Carolina E & G	Hydro	174,360	.....	.....	.....	.....	.....	.....
	Steam	407,500	.....	.....	275,000	.....	137,000	412,000
	IC	150	.....	.....	.....	.....	.....	.....
	Total	582,010	.....	.....	275,000	.....	137,000	412,000
Tampa Electric	Steam	253,500	.....	125,000	125,000	.....	.....	250,000
Virginia Electric & Power	Hydro	138,119	.....	.....	.....	.....	87,000	87,000
	Steam	1,003,250	.....	150,000	300,000	150,000	.....	600,000
	IC	1,200	.....	.....	.....	.....	.....	.....
	Total	1,142,569	.....	150,000	300,000	150,000	87,000	687,000
Yankee Atomic Electric	Steam	.....	.....	.....	.....	.....	125,000	125,000
Total	**Hydro**	**1,521,254**	**5,000**	.....	.....	**60,000**	**87,000**	**147,000**
	Steam	**11,002,822**	**803,000**	**1,118,000**	**2,925,000**	**1,680,000**	**837,000**	**6,560,000**
	IC	**15,178**	.....	**2,285**	.....	.....	.....	**2,285**
	Total	**12,539,254**	**808,000**	**1,120,285**	**2,925,000**	**1,740,000**	**924,000**	**6,709,285**
Municipal, State and Power District Systems								
Crisp County, Ga	Hydro	17,000	5,000	.....	.....	.....	.....	.....
	Steam	.....	.....	12,500	.....	.....	.....	12,500
	GT	.....	.....	5,000	.....	.....	.....	5,000
	Total	17,000	5,000	17,500	.....	.....	.....	17,500
Danville, Va	Hydro	10,125	.....	.....	.....	.....	.....	.....
	Steam	29,500	.....	.....	.....	.....	15,000	15,000
	Total	39,625	.....	.....	.....	.....	15,000	15,000
Dover, Del	Steam	10,750	6,250	.....	.....	.....	.....	.....
Hagerstown, Md	Steam	18,800	.....	.....	12,500	.....	12,500	25,000
	IC	1,000	1,000	.....	.....	.....	.....	.....
	Total	19,800	1,000	.....	12,500	.....	12,500	25,000
Jacksonville, Fla	Steam	255,500	.....	44,000	66,000	.....	132,000	242,000
Key West, Fla	Steam	10,000	.....	16,500	.....	.....	.....	16,500
	IC	6,190	.....	.....	.....	.....	.....	.....
	Total	16,190	.....	16,500	.....	.....	.....	16,500
Kinston, N. C	Steam	30,150	12,650	.....	.....	.....	.....	.....
Lakeland, Fla	Steam	62,500	25,000	.....	.....	.....	.....	.....
Orlando, Fla	Steam	106,000	33,000	.....	.....	.....	91,000	91,000
	GT	.....	.....	33,000	.....	.....	.....	33,000
	Total	106,300	33,000	33,000	.....	.....	91,000	124,000
S. C. Public Service Authority	Hydro	134,535	.....	.....	.....	.....	.....	.....
	Steam	88,000	.....	.....	.....	.....	100,000	100,000
	Total	222,535	.....	.....	.....	.....	100,000	100,000
St. Cloude, Fla	IC	1,700	1,700	.....	.....	.....	.....	.....
Tallahassee, Fla	Steam	22,500	.....	22,000	.....	.....	.....	22,000
Vero Beach, Fla	IC	8,525	.....	5,400	.....	.....	.....	5,400
Total	**Hydro**	**161,660**	**5,000**	.....	.....	.....	.....	.....
	Steam	**633,700**	**76,900**	**95,000**	**78,500**	.....	**350,500**	**524,000**
	IC	**17,415**	**2,700**	**5,400**	.....	.....	.....	**5,400**
	GT	.....	.....	**38,000**	.....	.....	.....	**38,000**
	Total	**812,775**	**84,600**	**138,400**	**78,500**	.....	**350,500**	**567,400**
Federal Agencies								
Corps of Engineers	Hydro	572,000	.....	116,000	.....	.....	366,000	482,000
South Atlantic	**Hydro**	**2,254,914**	**10,000**	**116,000**	.....	**60,000**	**453,000**	**629,000**
Total All Agencies	**Steam**	**11,636,522**	**879,900**	**1,213,000**	**3,003,500**	**1,680,000**	**1,187,500**	**7,084,000**
	IC	**32,593**	**2,700**	**7,685**	.....	.....	.....	**7,685**
	GT	.....	.....	**38,000**	.....	.....	.....	**38,000**
	Total	**13,924,029**	**892,600**	**1,374,685**	**3,003,500**	**1,740,000**	**1,640,500**	**7,758,685**

EAST SOUTH CENTRAL

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Power Companies								
Alabama Power	Hydro	489,700	.....	.....	.....	.....	.....	.....
	Steam	1,046,250	167,400	.....	181,500	246,000	.....	427,500
	Total	1,535,950	167,400	.....	181,500	246,000	.....	427,500
Kentucky Utilities	Hydro	30,540	.....	.....	.....	.....	.....	.....
	Steam	321,250	.....	100,000	.....	100,000	.....	200,000
	Total	351,790	.....	100,000	.....	100,000	.....	200,000
Louisville G & E	Hydro	80,000	.....	.....	.....	.....	.....	.....
	Steam	625,000	.....	.....	125,000	.....	125,000	250,000
	Total	705,000	.....	.....	125,000	.....	125,000	250,000
Mississippi Power	Steam	147,500	.....	75,000	.....	.....	.....	75,000
Mississippi P & L	Steam	407,000	.....	.....	.....	220,000	.....	220,000
	IC	3,450	.....	.....	.....	.....	.....	.....
	Total	410,450	.....	.....	.....	220,000	.....	220,000

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
East South Central (continued)								
Southern Electric Generating	Steam	.....	.....	.....	.....	.....	200,000	200,000
Tapoco	Hydro	121,500	.....	50,000	.....	.....	.....	50,000
Total	**Hydro**	**721,740**	.....	**50,000**	.....	.....	.....	**50,000**
	Steam	**2,547,000**	**167,400**	**175,000**	**306,500**	**566,000**	**325,000**	**1,372,500**
	IC	**3,450**	.....	.....	.....	.....	.....	.....
	Total	**3,272,190**	**167,400**	**225,000**	**306,500**	**566,000**	**325,000**	**1,422,500**
Municipal, State and Power District Systems								
Henderson, Ky.	Steam	10,000	12,650	.....	.....	.....	.....	.....
	IC	2,460	.....	.....	.....	.....	.....	.....
	Total	12,460	12,650	.....	.....	.....	.....	.....
Memphis, Tenn.	Steam	.....	.....	.....	250,000	500,000	.....	750,000
Total	**Steam**	**10,000**	**12,650**	.....	**250,000**	**500,000**	.....	**750,000**
	IC	**2,460**	.....	.....	.....	.....	.....	.....
	Total	**12,460**	**12,650**	.....	**250,000**	**500,000**	.....	**750,000**
Federal Agencies								
Corps of Engineers	Hydro	189,000	.....	30,000	36,000	.....	130,000	196,000
Tennessee Valley Authority	Hydro	2,742,500	74,500	75,000	.....	.....	.....	75,000
	Steam	6,062,250	550,000	450,000	555,000	575,000	.....	1,580,000
	Total	8,804,750	624,500	525,000	555,000	575,000	.....	1,655,000
Total	**Hydro**	**2,931,500**	**74,500**	**105,000**	**36,000**	.....	**130,000**	**271,000**
	Steam	**6,062,250**	**550,000**	**450,000**	**555,000**	**575,000**	.....	**1,580,000**
	Total	**8,993,750**	**624,500**	**555,000**	**591,000**	**575,000**	**130,000**	**1,851,000**
East South Central	**Hydro**	**3,653,240**	**74,500**	**155,000**	**36,000**	.....	**130,000**	**321,000**
Total All Agencies	**Steam**	**8,619,250**	**730,050**	**625,000**	**1,111,500**	**1,641,000**	**325,000**	**3,702,500**
	IC	**5,910**	.....	.....	.....	.....	.....	.....
	Total	**12,278,400**	**804,550**	**780,000**	**1,147,500**	**1,641,000**	**455,000**	**4,023,500**

WEST SOUTH CENTRAL

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Power Companies								
Central Louisiana Electric	Steam	115,000	54,000	.....	60,000	.....	100,000	160,000
	IC	19,605	.....	.....	.....	.....	.....	.....
	Total	134,605	54,000	.....	60,000	.....	100,000	160,000
Central P & L	Hydro	15,000	.....	.....	.....	.....	.....	.....
	Steam	448,000	75,000	.....	75,000	175,000	290,000	540,000
	IC	2,920	.....	.....	.....	.....	.....	.....
	Total	465,920	75,000	.....	75,000	175,000	290,000	540,000
Dallas P & L	Steam	621,250	115,000	125,000	125,000	.....	175,000	425,000
	IC	6,000	.....	.....	.....	.....	.....	.....
	Total	627,250	115,000	125,000	125,000	.....	175,000	425,000
El Paso Electric	Steam	140,800	.....	44,000	44,000	75,000	.....	163,000
Gulf States Utilities	Steam	783,500	100,000	.....	200,000	250,000	300,000	750,000
Houston Lighting & Power	Steam	1,327,500	156,250	.....	378,500	376,250	440,000	1,194,750
	Total	1,327,500	156,250	.....	378,500	376,250	440,000	1,194,750
Louisiana P & L	Steam	466,000	.....	.....	210,000	.....	.....	210,000
New Orleans Public Service	Steam	420,000	.....	102,000	.....	.....	.....	102,000
	Total	420,000	.....	102,000	.....	.....	.....	102,000
Oklahoma G & E	Steam	641,496	150,000	.....	150,000	200,000	.....	350,000
	IC	5,599	.....	.....	.....	.....	.....	.....
	GT	7,500	.....	.....	.....	.....	.....	.....
	Total	654,595	150,000	.....	150,000	200,000	.....	350,000
Public Service of Oklahoma	Steam	170,000	170,000	40,000	170,000	.....	170,000	380,000
Southwestern Electric Service	Steam	11,000	.....	.....	.....	.....	.....	.....
	IC	4,347	300	.....	.....	.....	.....	.....
	Total	15,347	300	.....	.....	.....	.....	.....
Southwestern Gas & Electric	Steam	365,000	84,000	114,000	.....	114,000	228,000	456,000
Southwestern Public Service	Hydro	330	.....	.....	.....	.....	.....	.....
	Steam	579,000	.....	75,000	.....	.....	.....	75,000
	IC	12,651	.....	.....	.....	.....	.....	.....
	Total	591,981	.....	75,000	.....	.....	.....	75,000
Texas Electric Service	Steam	663,050	175,000	.....	115,000	220,000	.....	335,000
	IC	11,396	.....	.....	.....	.....	.....	.....
	Total	674,446	175,000	.....	115,000	220,000	.....	335,000
Texas P & L	Steam	446,300	.....	.....	156,250	200,000	.....	356,250
	IC	7,450	.....	.....	.....	.....	.....	.....
	GT	3,500	.....	.....	.....	.....	.....	.....
	Total	457,250	.....	.....	156,250	200,000	.....	356,250
West Texas Utilities	Steam	205,500	.....	.....	.....	91,500	.....	91,500
	IC	11,892	.....	1,000	.....	.....	.....	1,000
	GT	5,000	.....	.....	5,000	.....	.....	5,000
	Total	222,392	.....	1,000	5,000	91,500	.....	97,500
Total	**Hydro**	**15,330**	.....	.....	.....	.....	.....	.....
	Steam	**7,403,396**	**1,079,250**	**500,000**	**1,683,750**	**1,701,750**	**1,703,000**	**5,588,500**
	IC	**81,860**	**300**	**1,000**	.....	.....	.....	**1,000**
	GT	**16,000**	.....	.....	**5,000**	.....	.....	**5,000**
	Total	**7,516,586**	**1,079,550**	**501,000**	**1,688,750**	**1,701,750**	**1,703,000**	**5,594,500**

(West South Central Continued)

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Municipal, State and Power District Systems								
Alexandria, La.	Steam	21,500	16,500	16,500	.....	.....	.....	16,500
Austin, Texas	Steam	110,000	.....	.....	40,000	100,000	.....	140,000
Brady, Texas	IC	5,000	.....	1,500	.....	.....	.....	1,500
Brownsville, Texas	Steam	.....	.....	.....	22,000	.....	.....	22,000
Bryan, Texas	Steam	21,500	.....	.....	22,000	.....	.....	22,000
	IC	4,790	.....	.....	.....	.....	.....	.....
	Total	26,290	.....	.....	.....	.....	.....	.....
Byron, Texas	Steam	21,500	.....	22,000	.....	.....	.....	22,000
	IC	4,790	.....	.....	.....	.....	.....	.....
	Total	26,290	.....	22,000	.....	.....	.....	22,000
Garland, Texas	Steam	.....	19,750	18,750	.....	.....	.....	18,750
Greenville, Texas	IC	12,960	.....	.....	.....	12,650	12,650	25,300
Houma, La.	IC	8,900	.....	.....	.....	.....	.....	.....
	GT	.....	.....	.....	14,000	.....	.....	14,000
	Total	8,900	.....	.....	14,000	.....	.....	14,000
Jonesboro, Ark.	Steam	.....	.....	.....	12,650	.....	.....	12,650
	IC	1,000	1,000	.....	.....	.....	.....	.....
	Total	1,000	1,000	.....	12,650	.....	.....	12,650
Lafayette, La.	Steam	8,000	12,650	.....	.....	20,000	.....	20,000
	IC	6,282	.....	.....	.....	.....	.....	.....
	Total	14,282	12,650	.....	.....	20,000	.....	20,000
Liberty, Texas	IC	3,540	1,320	.....	2,000	.....	2,000	4,000
Lubbock, Texas	Steam	30,500	.....	22,000	22,000	.....	.....	44,000
	IC	14,000	.....	.....	.....	.....	.....	.....
	Total	44,500	.....	22,000	22,000	.....	.....	44,000
Minden, La.	IC	7,377	.....	2,500	.....	.....	.....	2,500
Monroe, La.	Steam	36,375	9,375	.....	.....	.....	.....	.....
Raton, N. M.	Steam	6,000	.....	.....	.....	.....	5,000	5,000
Rayne, La.	IC	4,370	.....	.....	.....	.....	1,500	1,500
Robstown, Texas	IC	7,250	1,000	.....	3,000	.....	3,000	6,000
Salt River Project	Hydro	70,890	.....	.....	.....	.....	.....	.....
	Steam	120,000	.....	100,000	100,000	.....	.....	200,000
	IC	10,000	.....	.....	.....	.....	.....	.....
	Total	200,890	.....	100,000	100,000	.....	.....	200,000
San Antonio, Texas	Steam	420,000	105,000	.....	105,000	105,000	165,000	375,000
Vernon, Texas	IC	.....	.....	.....	2,500	.....	7,500	10,000
Total	**Hydro**	**70,890**	.....	.....	.....	.....	.....	.....
	Steam	**795,375**	**163,275**	**179,250**	**323,650**	**225,000**	**170,000**	**897,900**
	IC	**90,259**	**3,320**	**4,000**	**7,500**	**12,650**	**26,650**	**50,800**
	GT	.....	.....	.....	**14,000**	.....	.....	**14,000**
	Total	**956,524**	**166,595**	**183,250**	**345,150**	**237,650**	**196,650**	**962,700**
Federal Agencies								
Corps of Engineers	Hydro	501,000	.....	.....	50,000	50,000	807,000	907,000
Southwestern Power Administration	Hydro	501,000	.....	.....	.....	100,000	435,000	535,000
Total	**Hydro**	**100,200**	.....	.....	**50,000**	**150,000**	**1,242,000**	**1,442,000**
	Total	**100,200**	.....	.....	**50,000**	**150,000**	**1,242,000**	**1,442,000**
West South Central	**Hydro**	**186,420**	.....	.....	**50,000**	**150,000**	**1,242,000**	**1,442,000**
Total All Agencies	**Steam**	**8,198,771**	**1,212,525**	**679,250**	**2,007,400**	**1,926,750**	**1,873,000**	**6,486,400**
	IC	**172,119**	**3,620**	**5,000**	**7,500**	**12,650**	**26,650**	**51,800**
	GT	**16,000**	.....	.....	**19,000**	.....	.....	**19,000**
	Total	**8,573,310**	**1,246,145**	**684,250**	**2,083,900**	**2,089,400**	**3,141,650**	**7,999,200**

MOUNTAIN

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Power Companies								
Arizona Public Service	Hydro	7,000	.....	.....	.....	.....	.....	.....
	Steam	361,500	.....	.....	.....	25,000	245,000	270,000
	IC	24,300	.....	.....	.....	.....	.....	.....
	Total	392,800	.....	.....	.....	25,000	245,000	270,000
Idaho Power	Hydro	371,700	.....	.....	588,000	.....	312,800	900,800
	IC	1,350	.....	.....	.....	.....	.....	.....
	Total	373,050	.....	.....	588,000	.....	312,800	900,800
Montana Power	Hydro	421,940	.....	60,000	.....	.....	35,000	95,000
	Steam	60,000	.....	.....	.....	.....	.....	.....
	Total	481,940	.....	60,000	.....	.....	35,000	95,000
Public Service Co. of Colorado	Hydro	41,635	.....	.....	.....	.....	.....	.....
	Steam	483,100	122,000	.....	.....	110,000	158,000	268,000
	IC	2,250	.....	.....	.....	.....	.....	.....
	Total	526,985	122,000	.....	.....	110,000	158,000	268,000
Public Service Co. of New Mexico	Steam	.....	.....	33,500	.....	45,000	66,000	144,500

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Mountain (continued)								
Southern Colorado Power	Hydro	1,500	.....	.....	.....	.....	.....	.....
	Steam	64,968	.....	.....	20,000	.....	.....	20,000
	Total	66,468	.....	.....	20,000	.....	.....	20,000
Southern Nevada Power	Steam	44,000	.....	60,000	.....	.....	60,000	120,000
Tucson Gas, El & P....	Steam	100,500	.....	.....	75,000	.....	75,000	150,000
	IC	13,000	.....	.....	.....	.....	.....	.....
	Total	113,500	.....	.....	75,000	.....	75,000	150,000
Utah P & L.....	Hydro	171,560	.....	.....	.....	.....	.....	.....
	Steam	410,750	.....	105,000	.....	.....	.....	105,000
	IC	3,470	.....	.....	.....	.....	.....	.....
	Total	585,780	.....	105,000	.....	.....	.....	105,000
Total.....	**Hydro**	**1,015,335**	.....	**60,000**	**588,000**	.....	**347,800**	**995,800**
	Steam	**1,524,818**	**122,000**	**198,500**	**95,000**	**180,000**	**604,000**	**1,077,500**
	IC	**44,370**	.....	.....	.....	.....	.....	.....
	Total	**2,584,523**	**122,000**	**258,500**	**683,000**	**180,000**	**951,800**	**2,073,300**
Municipal, State and Power District Systems								
Colorado Springs, Colo.	Hydro	6,000	.....	.....	.....	.....	.....	.....
	Steam	55,000	.....	22,000	.....	.....	33,000	55,000
	Total	61,000	.....	22,000	.....	.....	33,000	55,000
Gallup, N.M.....	Steam	14,250	6,250	.....	.....	.....	.....	.....
La Junta, Colo.....	IC	4,180	.....	2,250	.....	.....	.....	2,250
Salt River Project.....	Hydro	70,890	.....	.....	.....	.....	.....	.....
	Steam	120,000	.....	100,000	100,000	.....	.....	200,000
	IC	10,000	.....	.....	.....	.....	.....	.....
	Total	200,890	.....	100,000	100,000	.....	.....	200,000
Walsenburg, Colo....	Steam	.....	.....	6,250	.....	.....	.....	6,250
Total.....	**Hydro**	**76,890**	.....	.....	.....	.....	.....	.....
	Steam	**189,250**	**6,250**	**128,250**	**100,000**	.....	**33,000**	**261,250**
	IC	**14,180**	.....	**2,250**	.....	.....	.....	**2,250**
	Total	**280,320**	**6,250**	**130,500**	**100,000**	.....	**33,000**	**263,500**
Cooperatives								
Colorado-Ute Electric Ass'n	Steam	.....	.....	.....	.....	25,300	.....	25,300
Plains Electric G & T...	Steam	33,000	.....	.....	16,500	.....	.....	16,500
Total.....	**Steam**	**33,000**	.....	.....	**16,500**	**25,300**	.....	**41,800**
	Total	**33,000**	.....	.....	**16,500**	**25,300**	.....	**41,800**

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Federal Agencies								
Bureau of Reclamation.	Hydro	2,351,350	28,500	90,500	24,000	4,500	1,830,100	1,949,100
Corps of Engineers....	Hydro	127,600	.....	.....	.....	.....	80,000	80,000
Total.....	**Hydro**	**2,478,950**	**28,500**	**90,500**	**24,000**	**4,500**	**1,910,100**	**2,029,100**
	Total	**2,478,950**	**28,500**	**90,500**	**24,000**	**4,500**	**1,910,100**	**2,029,100**
Mountain.....	**Hydro**	**3,571,175**	**28,500**	**150,500**	**612,000**	**4,500**	**2,257,900**	**3,024,900**
Total All Agencies...	**Steam**	**1,747,068**	**128,250**	**326,750**	**211,500**	**205,300**	**637,000**	**1,380,550**
	IC	**58,550**	.....	**2,250**	.....	.....	.....	**2,250**
	Total	**5,376,793**	**156,750**	**479,500**	**823,500**	**209,800**	**2,894,900**	**4,407,700**

Pacific

Power Companies								
California Electric Power	Hydro	87,570	.....	.....	.....	.....	.....	.....
	Steam	140,000	.....	60,000	60,000	75,000	120,000	315,000
	Total	227,570	.....	60,000	60,000	75,000	120,000	315,000
California Oregon Power	Hydro	310,040	34,000	2,800	80,000	.....	516,500	599,300
	IC	985	.....	.....	.....	.....	.....	.....
	Total	311,025	34,000	2,800	80,000	.....	516,500	599,300
Pacific G & E.....	Hydro	1,451,500	.....	.....	470,500	.....	.....	470,500
	Steam	3,076,500	210,200	5,000	215,000	.....	205,000	425,000
	Total	4,528,000	210,200	5,000	685,500	.....	205,000	895,500
Pacific P & L.....	Hydro	236,426	.....	.....	286,000	.....	126,500	412,500
	Steam	93,520	.....	.....	100,000	.....	.....	100,000
	IC	6,060	.....	.....	.....	.....	.....	.....
	Total	336,006	.....	.....	386,000	.....	126,500	512,500
Portland General Electric	Hydro	121,825	.....	36,000	130,000	.....	.....	166,000
	Steam	88,000	.....	.....	.....	.....	.....	.....
	Total	209,825	.....	36,000	130,000	.....	.....	166,000
Puget Sound P & L..	Hydro	153,200	.....	20,000	.....	85,000	55,000	160,000
	Steam	85,000	.....	.....	.....	.....	.....	.....
	Total	238,200	.....	20,000	.....	85,000	55,000	160,000
San Diego G & E...	Steam	487,000	100,000	.....	100,000	.....	.....	100,000
Southern California Edison	Hydro	953,220	.....	.....	.....	.....	.....	.....
	Steam	1,511,450	334,000	330,000	400,000	400,000	.....	1,130,000
	IC	30,000	.....	.....	.....	.....	.....	.....
	Total	2,494,670	.....	330,000	400,000	400,000	.....	1,130,000
Washington Water Power	Hydro	354,650	.....	.....	.....	200,000	200,000	400,000

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
Pacific (continued)								
Total	Hydro	3,668,431	34,000	58,800	966,500	285,000	898,000	2,208,300
	Steam	5,481,470	644,200	395,000	875,000	475,000	325,000	2,070,000
	IC	37,045	.....	.....	.....	.....	.....	.....
	Total	9,186,946	678,200	453,800	1,841,500	760,000	1,223,000	4,278,300
Municipal, State and Power District Systems								
Burbank, Cal.	Hydro	5,100	.....	.....	.....	.....	.....	.....
	Steam	70,000	.....	.....	.....	44,000	44,000	88,000
	Total	75,100	.....	.....	.....	44,000	44,000	88,000
Ephrata, Wash.	Hydro	.....	.....	.....	.....	.....	1,200,800	1,200,800
Glendale, Cal.	Steam	60,000	.....	.....	.....	40,000	.....	40,000
Hetch Hetchy Water & Power	Hydro	70,000	.....	.....	.....	135,000	67,500	202,500
Imperial Irrigation District	Hydro	67,400	33,000	.....	.....	.....	.....	.....
	Steam	50,000	.....	44,000	.....	.....	.....	44,000
	IC	13,276	.....	.....	.....	.....	.....	.....
	Tota	130,676	33,000	44,000	.....	.....	.....	44,000
Los Angeles, Cal.	Hydro	733,000	.....	3,200	.....	.....	.....	3,200
	Steam	934,000	156,000	.....	156,000	156,000	.....	312,000
	Total	1,667,000	156,000	3,200	156,000	156,000	.....	315,200
Oakdale & South San Joaquin	Hydro	.....	.....	81,000	.....	.....	.....	81,000
Pasadena, Cal.	Steam	115,000	.....	40,000	.....	.....	60,000	100,000
PUD No. 1 Cowlitz County, Wash.	Hydro	.....	.....	.....	86,000	.....	100,000	186,000
PUD No. 2 Grant County, Wash.	Hydro	.....	.....	.....	.....	.....	632,000	632,000
Seattle, Wash.	Hydro	641,656	116,000	.....	57,000	.....	600,000	657,000
	Steam	51,000	.....	.....	.....	.....	.....	.....
	Total	692,656	116,000	.....	57,000	.....	600,000	657,000
State Power Commission, Wash.	Steam	.....	.....	.....	312,000	.....	.....	312,000
Tacoma, Wash.	Hydro	238,000	.....	.....	.....	.....	40,000	40,000
	Steam	59,000	.....	.....	.....	.....	.....	.....
	Total	297,000	.....	.....	.....	.....	40,000	40,000
Turlock Irrigation District	Hydro	25,000	.....	.....	.....	.....	65,000	65,000
Total	Hydro	1,780,156	149,000	84,200	143,000	135,000	2,705,300	3,067,500
	Steam	1,339,000	156,000	84,000	468,000	240,000	104,000	896,000
	IC	13,276	.....	.....	.....	.....	.....	.....
	Total	3,132,432	305,000	168,200	611,000	375,000	2,809,300	3,963,500
Federal Agencies								
Bureau of Reclamation	Hydro	2,615,500	12,000	.....	11,250	16,000	233,000	260,250
Corps of Engineers	Hydro	2,199,440	472,000	476,000	568,000	312,000	1,319,000	2,675,000
Total	Hydro	4,814,940	484,000	476,000	579,250	328,000	1,552,000	2,935,250
	Total	4,814,940	484,000	476,000	579,250	328,000	1,552,000	2,935,250
Pacific	Hydro	10,263,527	667,000	619,000	1,688,750	748,000	5,155,300	8,211,050
Total All Agencies	Steam	6,820,470	800,200	479,000	1,343,000	715,000	429,000	2,966,000
	IC	50,321	.....	.....	.....	.....	.....	.....
	Total	17,134,318	1,467,200	1,098,000	3,031,750	1,463,000	5,584,300	11,177,050

Total United States

Hydro	24,409,491	1,056,508	1,298,100	3,004,950	1,559,500	10,239,600	16,102,150
Steam	89,132,695	6,217,575	8,051,750	14,302,550	11,721,750	9,397,000	43,473,050
IC	951,122	29,475	85,210	43,845	18,750	79,150	226,955
Total	114,493,308	7,303,558	9,435,060	17,351,345	13,300,000	19,715,750	59,802,155

U. S. Possessions

Alaska El & P Co.	Hydro	1,600	.....	.....	.....	.....	.....	.....
	IC	2,500	.....	.....	.....	2,500	.....	2,500
	Total	4,100	.....	.....	.....	2,500	.....	2,500
Anchorage, Alaska	IC	6,736	.....	1,100	2,500	.....	7,500	11,100
Chugach, Alaska	Steam	9,500	.....	5,000	.....	.....	.....	5,000
	IC	3,595	.....	.....	.....	.....	.....	.....
	Total	13,095	.....	5,000	.....	.....	.....	5,000
Cordova, Alaska	IC	1,000	.....	.....	600	.....	.....	600
Kenai Lake, Alaska	IC	100	.....	95	.....	.....	350	445
Ketchikan, Alaska	Hydro	9,800	.....	1,500	.....	.....	4,500	6,000
	IC	942	.....	.....	.....	.....	.....	.....
	Total	10,742	.....	1,500	.....	.....	4,500	6,000
Kodiak Electric Ass'n.	Hydro	.....	.....	.....	.....	.....	2,000	2,000
	IC	2,018	.....	1,200	.....	.....	.....	1,200
	Total	2,018	.....	1,200	.....	.....	2,000	3,200

	Prime Mover	Capacity End 1956	1956	1957	1958	1959	After 1959	Total Additions Now Planned
U. S. Possessions (Continued)								
Sitka Public Utilities	IC	350	.....	.....	1,000	.....	.....	1,000
Wrangell, Alaska	IC	800	.....	650	.....	.....	.....	650
Hawaiian Electric Co	Steam	277,500	.....	50,000	.....	50,000	50,000	150,000
Hilo Electric Light Co	Hydro	3,400	.....	.....	.....	.....	.....	.....
	Steam	17,000	.....	7,500	.....	15,000	.....	22,500
	IC	8,980	.....	.....	.....	.....	.....	.....
	Total	29,380	.....	7,500	.....	15,000	.....	22,500
Puerto Rico Water Resources Authority	Hydro	109,404	20,000	.....	.....	.....	.....	.....
	Steam	162,000	40,000	80,000	40,000	.....	60,000	180,000
	GT	.....	.....	.....	.....	40,000	.....	40,000
	Total	271,404	60,000	80,000	40,000	40,000	60,000	220,000
Virgin Islands Corp	Hydro	865	865	2,250	.....	.....	.....	2,250
	IC	5,895	.....	.....	.....	.....	.....	.....
	Total	6,760	865	2,250	.....	.....	.....	2,250
Total	**Hydro**	**125,069**	**20,865**	**3,750**	.....	.....	**6,500**	**10,250**
	Steam	**466,000**	**40,000**	**142,500**	**40,000**	**65,000**	**110,000**	**357,500**
	IC	**32,916**	.....	**3,045**	**4,100**	**2,500**	**7,850**	**17,495**
	GT	.....	.....	.....	.....	**40,000**	.....	**40,000**
	Total	**623,985**	**60,865**	**149,295**	**44,100**	**107,500**	**124,350**	**425,245**

CANADA

Aluminum Company of Canada	Hydro	2,475,000	270,000	135,000	135,000	135,000	900,000	1,305,000
British Columbia Electric Co	Hydro	648,200	42,000	195,000	.....	120,000	120,000	435,000
	Steam	12,444	.....	.....	.....	.....	.....	.....
	IC	1,580	.....	.....	.....	.....	90,000	90,000
	Total	662,224	42,000	195,000	.....	120,000	210,000	525,000
British Columbia Power Commission	Hydro	298,000	78,000	38,000	.....	.....	.....	38,000
	IC	36,100	3,100	.....	.....	.....	.....	.....
	Total	334,100	81,100	38,000	.....	.....	.....	38,000
Calgary Power	Hydro	222,000	.....	18,000	.....	79,000	.....	97,000
	Steam	70,000	70,000	.....	70,000	.....	100,000	170,000
	Total	292,000	70,000	18,000	70,000	79,000	100,000	267,000
Hydro-Electric Power Commission of Ontario	Hydro	3,671,220	64,000	290,500	760,500	445,500	180,000	1,676,500
	Steam	700,116	25,000	.....	235,000	258,500	235,000	728,500
	IC	1,725	.....	.....	.....	.....	.....	.....
	Total	4,373,061	89,000	290,500	995,500	704,000	415,000	2,405,000
Lethbridge, Alberta	Steam	14,860	.....	.....	.....	.....	.....	.....
	GT	.....	.....	8,000	.....	.....	.....	8,000
	Total	14,860	.....	8,000	.....	.....	.....	8,000
Manitoba Hydro-Electric Board	Hydro	482,000	.....	.....	.....	.....	140,000	140,000
	Steam	.....	.....	71,200	71,200	78,000	.....	220,400
	Total	482,000	.....	71,200	71,200	78,000	140,000	360,400
New Brunswick Electric Power Commission	Hydro	29,960	.....	72,000	.....	.....	.....	72,000
	Steam	72,250	22,000	.....	.....	.....	50,000	50,000
	IC	4,665	.....	.....	.....	.....	.....	.....
	Total	106,875	22,000	72,000	.....	.....	50,000	122,000
Newfoundland Light & Power Co	Hydro	43,500	.....	.....	15,000	.....	10,000	25,000
	Steam	11,800	11,800	.....	.....	23,000	.....	23,000
	IC	2,500	.....	.....	.....	.....	.....	.....
	Total	57,800	11,800	.....	15,000	23,000	10,000	48,000
NW Territories Power Commission	Hydro	10,000	.....	3,000	.....	.....	.....	3,000
	Steam	.....	.....	.....	500	.....	.....	500
	IC	937	150	.....	250	.....	.....	250
	Total	10,937	.....	3,000	750	.....	.....	3,750
Nova Scotia Light & Power Co	Hydro	45,926	.....	.....	.....	.....	.....	.....
	Steam	91,530	.....	58,250	.....	.....	58,250	116,500
	IC	2,550	.....	.....	.....	.....	.....	.....
	Total	140,006	.....	58,250	.....	.....	58,250	116,500
Nova Scotia Power Commission	Hydro	80,254	.....	4,500	36,000	.....	45,000	85,500
	Steam	41,125	.....	.....	.....	20,000	.....	20,000
	IC	2,037	.....	.....	.....	.....	.....	.....
	Total	123,416	.....	4,500	36,000	20,000	45,000	105,500
Quebec Hydro-Electric Commission	Hydro	1,952,000	375,000	255,000	360,000	631,000	304,000	1,550,000
Regina, Saskatchewan	Steam	85,000	.....	.....	.....	.....	.....	.....
	GT	.....	.....	.....	.....	20,000	.....	20,000
	Total	85,000	.....	.....	.....	20,000	.....	20,000
Saskatchewan Power Corp	Steam	169,000	33,000	30,000	132,000	132,000	264,000	558,000
	IC	27,000	9,000	.....	.....	.....	.....	.....
	GT	.....	.....	20,000	.....	.....	.....	20,000
	Total	196,000	42,000	50,000	132,000	132,000	264,000	578,000
Shawinigan Water & Power	Hydro	1,536,250	.....	.....	135,000	135,000	.....	270,000
United Towns Electric Co	Hydro	15,550	5,000	600	.....	.....	.....	600
	IC	350	250	.....	.....	.....	.....	.....
	Total	15,900	5,250	600	.....	.....	.....	600
Total	**Hydro**	**11,509,860**	**834,000**	**1,011,600**	**1,441,500**	**1,545,500**	**1,689,000**	**5,687,600**
	Steam	**1,268,125**	**161,800**	**159,450**	**508,700**	**510,500**	**708,250**	**1,886,900**
	IC	**79,444**	**12,500**	.....	**250**	.....	**90,000**	**90,250**
	GT	.....	.....	**28,000**	.....	**20,000**	.....	**48,000**
	Total	**12,857,429**	**1,008,300**	**1,199,050**	**1,950,450**	**2,076,000**	**2,487,250**	**7,712,750**

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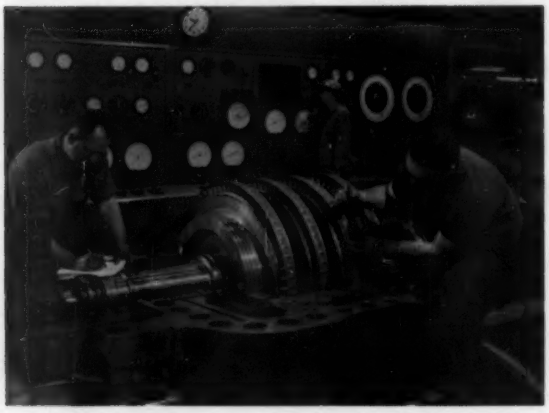
To help find answers to your power generation problems before they occur

TURBINE-GENERATOR TESTING PROGRAMS are co-ordinated in G.E.'s Turbine-Generator Development Laboratory.

Tomorrow's problems are explored today

IN GENERAL ELECTRIC'S TURBINE-GENERATOR DEVELOPMENT LABORATORY

Full-size turbine and generator parts and a great variety of development setups can be tested and evaluated for service performance at General Electric's Turbine-Generator Development Laboratory. Especially designed testing equipment—some described briefly on these pages—provides answers and engineering data that could not possibly be obtained before. This Laboratory, now in full operation, is of vital importance to all large steam turbine-generator development engineering. It supplements the Large Steam Turbine-Generator Department's Materials and Processes, and Air Test Laboratories.



INCREASE TURBINE EFFICIENCIES—High-pressure test turbine provides precise operating data on new bucket, nozzle, rotor and shell designs, leading to higher efficiencies.

INCREASE GENERATOR RATINGS—To increase generator ratings without great physical size increase, more effective dissipation of heat must be provided by improvements in the fans and the cooling systems. Prototypes of fans designed to cool higher-rated generators are run in this full-scale fan test setup. A new fan is being tested here for a 300,000-kw unit. Pressure-volume characteristics and efficiency can be determined—information vitally needed for good fan design.

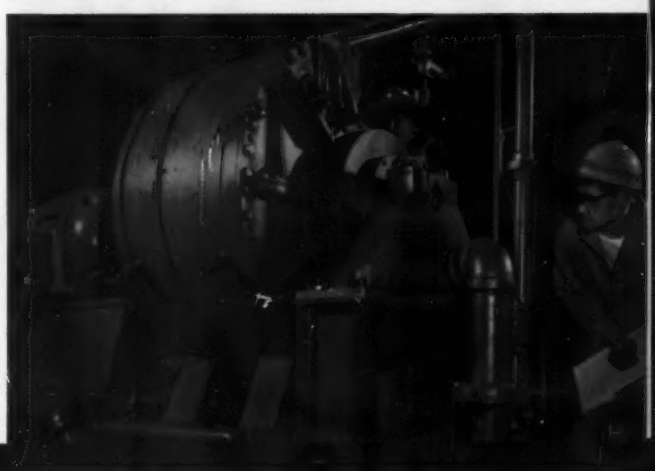
HIGH-SPEED BURST PIT shown on preceding page spins turbine and generator rotor cross sections and reveals fracture characteristics and effects of physical configurations.

DETERMINE TURBINE EFFICIENCY—Accurate determination of overall efficiencies of new turbine designs is one of the most important considerations in building future turbines. And an inherent part of this problem is the development of more accurate flow nozzles. Here, the calibration of a water flow nozzle is being checked, using large, highly accurate scales and weigh tanks.

IMPROVE THRUST BEARING DEPENDABILITY—Thrust bearings of larger capacity are required for the larger turbines being designed. The machine shown here is used to test new thrust bearing designs. Operating at 1800 or 3600-rpm, it can impose loads up to 450,000 lbs—equivalent to the weight of the Statue of Liberty. It is also used to measure oil and babbit temperatures, and oil film pressures and thicknesses under conditions tougher than those encountered in actual operation. This machine has proved the dependability of General Electric thrust bearings.

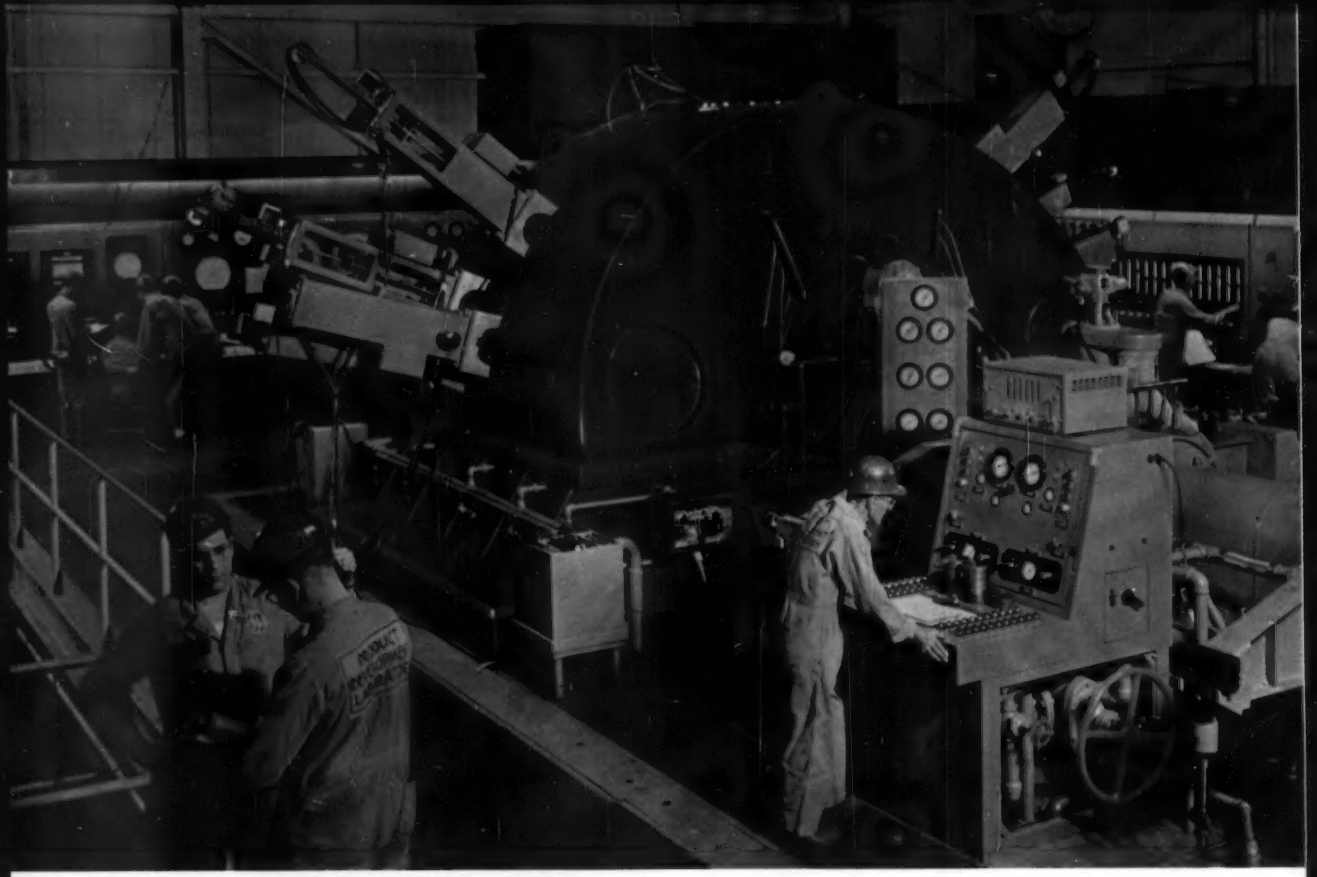
INCREASE GENERATOR INSULATION LIFE—Insulation is one of the most important factors affecting the life of a generator. That is why General Electric conducts extensive research aimed at prolonging insulation life. On this special "girth crack" test setup, a generator stator bar is subjected to simulated operating conditions. Thermal expansion is duplicated and ten years of operating cycles are condensed into four months of testing. Engineers can study and design new insulation systems that will reduce operating difficulties.

SIMPLIFY HYDROGEN SYSTEM—With this test set up General Electric engineers are working to develop a new shaft seal to permit the application of the continuous scavenging system on all generators regardless of size. This system requires no vacuum treatment of the oil.



Progress Is Our Most Important Product

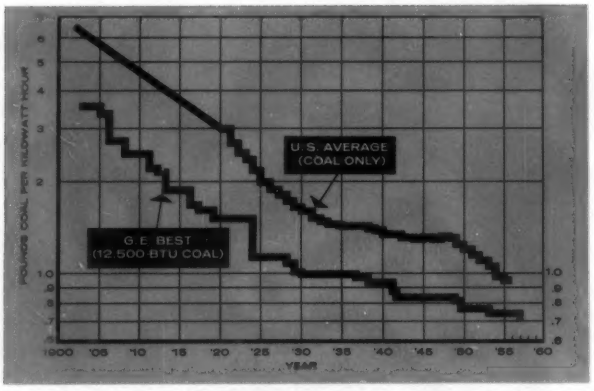
GENERAL ELECTRIC



FULL-SCALE, LOW-PRESSURE TEST TURBINE enables G-E engineers to evaluate new design concepts and to study turbine steam paths under actual operating conditions.

IN GENERAL ELECTRIC'S DEVELOPMENT LAB

Low-pressure turbines get critical study



STATION COAL RATE chart shows rapid progress in electrical equipment efficiency. U. S. average is from FPC reports, compared with station coal rates for G.E.'s most efficient units.

As the rating of steam turbines has continued to increase, a greater proportion of a unit's output is being produced by the low-pressure section. In addition, the advent of nuclear power has further established the importance of efficient use of the energy in this region.

The solution to problems in the low-pressure section can be evaluated in the Turbine-Generator Development Laboratory's full scale, low-pressure test turbine. Here the largest 3600-rpm turbine parts built by General Electric can be run under actual operation conditions.

With facilities like these, G-E engineers can solve power generation problems before they occur—so that tomorrow's turbine-generators will be even more efficient. For more information write for bulletin GED-2554, Large Steam Turbine-Generator Dept. General Electric Co., Schenectady 5, N.Y. 254-47

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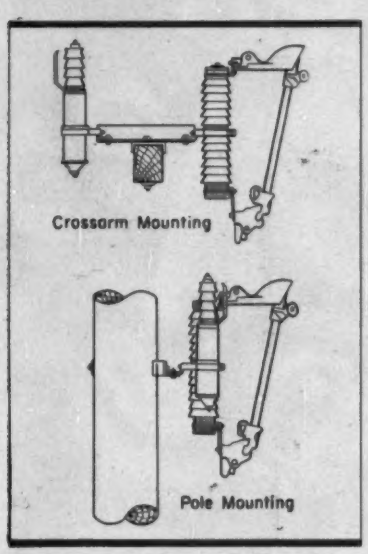
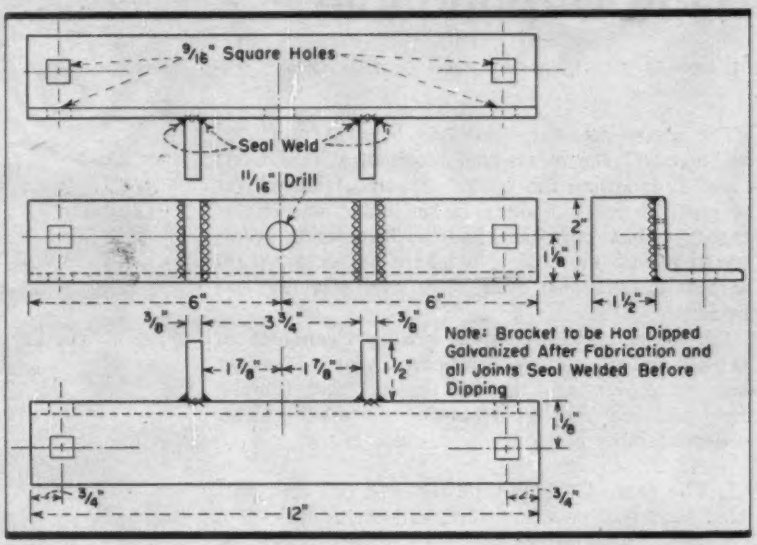




DISTRIBUTION—Design

Sturdier Bracket Cuts Costs of Mountings

E. J. O'CONNOR, Engineer, System Distribution Engineering, Florida Power Corp, St. Petersburgh, Fla.

A new bracket has been developed by Florida Power Corp for mounting a cutout and lightning arrester on a pole or crossarm. Compared with brackets in use, it provides a sturdier mounting, increases the clearance between cutout and arrester, and saves 75¢ per installation.

The bracket also reduces the stores problem.

Punched from Angle Iron

Originally, the bracket was fabricated by welding two ears to a 12-in. piece of 2 x 2 x ½-in. angle iron. Between the ears, a hole was punched in the angle iron for bolting to the pole or arm. Four holes near the ends of the bracket secure the equipment.

The ears are now punched out of the angle iron.

A ⅝ x 6-in. machine bolt and a 2½-in. square washer secure the bracket to a crossarm, and a 2½-in. square washer secure the bracket to a crossarm, and a ⅝ x 10-in. bolt and similar washer hold it to a distribution line pole.

Tests at 5,000 Amp

Fault-current tests were conducted to check the strength of the new bracket and the effect of the ears on the crossarm. A cutout mounted on a bracket which was bolted to an arm, was subjected to 100 shots at 5,000 amp. The bracket was not damaged, and there was no apparent splitting or splintering of the crossarm.

Clearance Too Small

Development of the bracket stems from the company's observation that the EEI-NEMA item supplied with cutouts and lightning arresters was not sturdy enough to withstand the recoil from the higher fault currents of 12-kv distribution. When the EEI-NEMA bracket is adapted to pole mounting, clearance between cutout and arrester is not sufficient for the voltage.

The new bracket has eliminated a stores problem. Previously, cutouts and arresters were purchased with EEI-NEMA brackets. For mounting the equipment on poles, only the L-sections were used, the backing plates and carriage bolts being left off. When an arm was used for the mounting, the L-sections were placed on each side of the arm.

The backing plates had to be stored or scrapped. As these parts have few uses, they soon took up too much storage space.

Material Costs Cut

The new bracket also reduces material costs. It sells for about $1.25, including bolts and washers. The old bracket cost about $1.00 each.

Thus, on most installations—which include a cutout and arrester—the saving is 75¢.

(More How To on page 168)

GENERATION—Operation

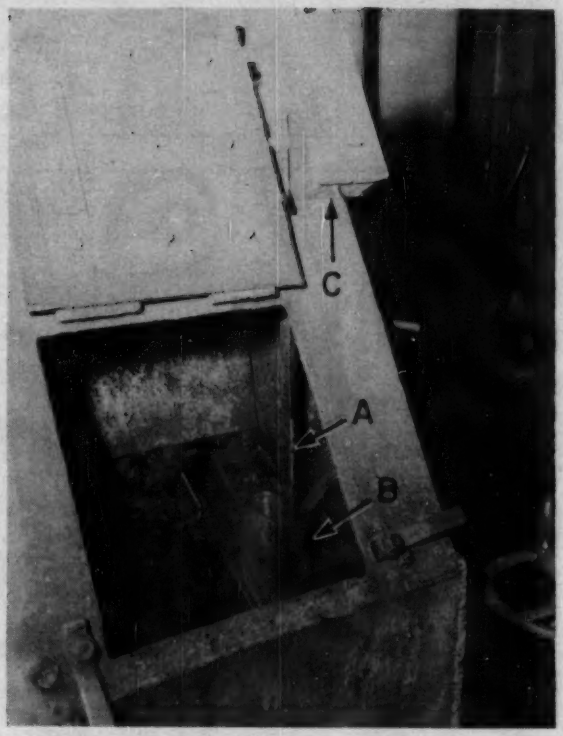
'No-Coal' Alarms Made Dependable

E. L. KOHLER, Philo Plant, Ohio Power Co, Philo, Ohio

The alarm actuator illustrated here has replaced the "no-coal" alarms on coal boxes of Philo's Units 4 and 5, following the latters' repeated failures over the past 13 years. Failure of the older alarms was caused by dust, corrosion, and the hammering necessary to release the coal. No failure has occurred on the new installations, even when coal was dry and powdery.

The alarm actuator assures greater cleanliness in the plant and saves many man-hours a year in clean-up work by preventing the coal feeders from running empty and coal dust from blowing around the plant. Its dependability is derived from these factors:

1. The contactor is outside the coal box and protected from coal dust, moisture, and corrosion.
2. The pendulum-type actuator has greater leverage and more positive action.
3. A fairly stiff coiled spring returns the lever to the vertical signalling position when no coal runs through the box.



NO-COAL ALARM was redesigned for actuator consisting of (A) paddle arm, (B) shield, (C) enclosed mercury switch

The alarm-actuating lever (A), attached to a horizontal shaft carrying a mercury switch in a control box (C), extends downward through a 2½ x 5 x 9-in. shield (B), which protects it from obstructions liable to build up on the coal grid. The lever terminates in a paddle which is deflected by the coal stream. The lever, or paddle arm, has a free movement of 5 in. at the bottom of the shield, enough to tilt the mercury switch at the top.

The coal level desired can be regulated by shortening or lengthening the paddle arm. When no coal is flowing, a coiled spring holds the arm in a vertical position which sounds an alarm. When coal flows the paddle is deflected sufficiently to cut off the alarm.

The mercury switch is enclosed in a 3 x 4 x 9-in. steel box (C), mounted on the sloping front of the coal box. The switch-tilting shaft passes through a steel pillow-block type bearing. The actuating arm passes through a slot in the coal box immediately below the control box. The mercury-switch clamp on the shaft is adjusted so that the switch just closes when the paddle arm is vertical, thus allowing the longest travel of the arm and minimizing false alarms caused by powdery coal.

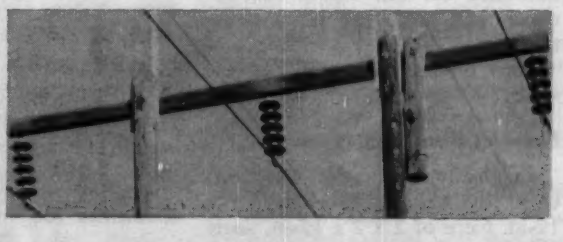
TRANSMISSION—Operation

Limits Woodpecker Damage

Damage by woodpeckers to poles of Public Service Co of Oklahoma has been lessened considerably by the practice of bolting a section of an old pole to a newly erected one. The birds chew happily on the old section—sometimes.

Apparently the woodpeckers leave the old pole alone, when it is left standing in its old position, or when it is placed at some distance from the new pole. But bolting the old pole to the new one carries the 60-cps hum to the old pole, which thereby retains its attraction for the birds.

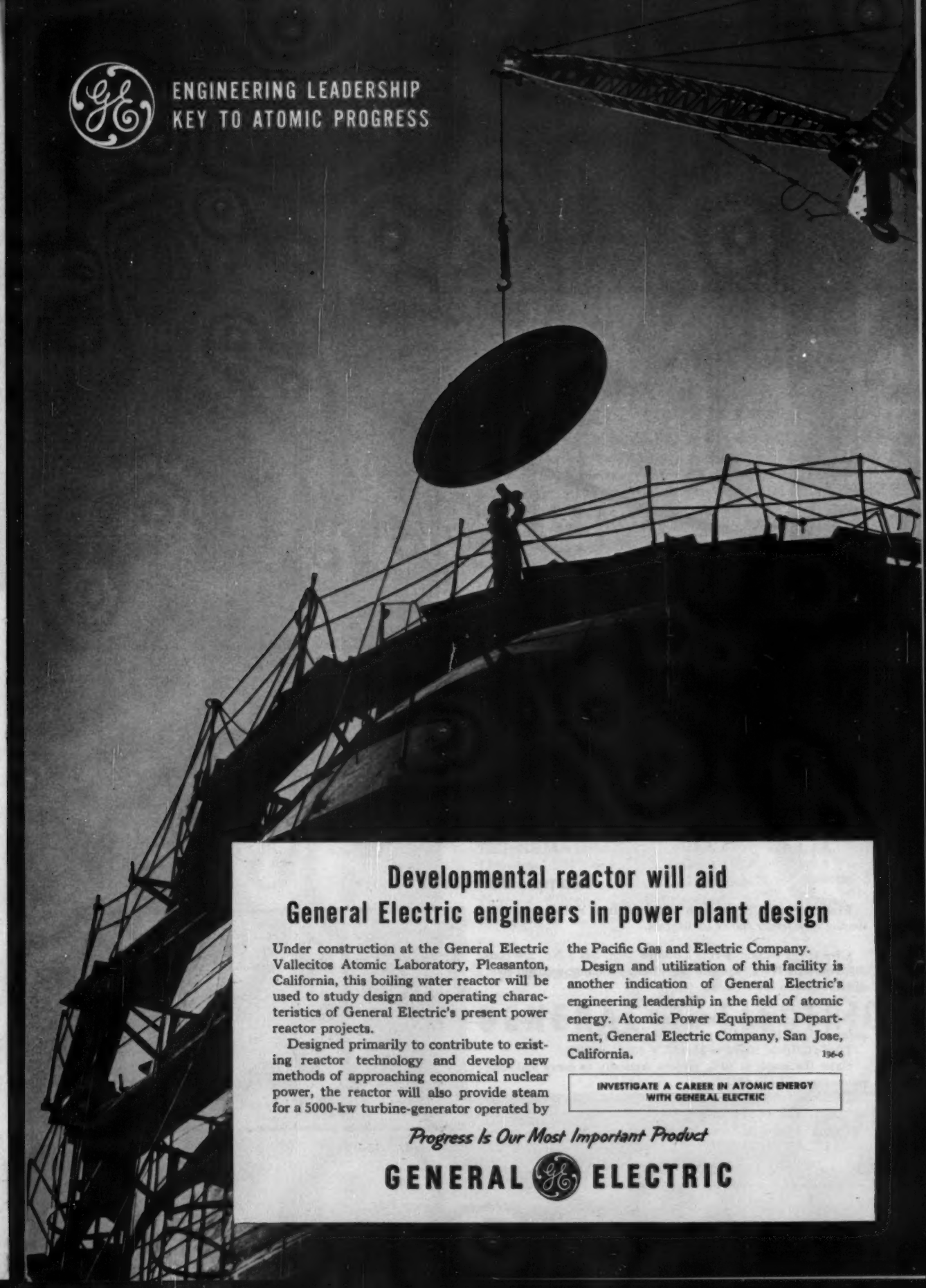
When the company finds a pecked pole that is still in good condition, the hole is filled with a compound



to delimit further damage from rot. A white circle is then painted around the hole to warn linemen against jabbing their spikes into the soft place while they are climbing.

Company engineers claim that they have never lost a pole protected in this manner, although they have lost a pole directly across from it.

ENGINEERING LEADERSHIP
KEY TO ATOMIC PROGRESS



Developmental reactor will aid General Electric engineers in power plant design

Under construction at the General Electric Vallecitos Atomic Laboratory, Pleasanton, California, this boiling water reactor will be used to study design and operating characteristics of General Electric's present power reactor projects.

Designed primarily to contribute to existing reactor technology and develop new methods of approaching economical nuclear power, the reactor will also provide steam for a 5000-kw turbine-generator operated by the Pacific Gas and Electric Company.

Design and utilization of this facility is another indication of General Electric's engineering leadership in the field of atomic energy. Atomic Power Equipment Department, General Electric Company, San Jose, California. 196-6

INVESTIGATE A CAREER IN ATOMIC ENERGY WITH GENERAL ELECTRIC

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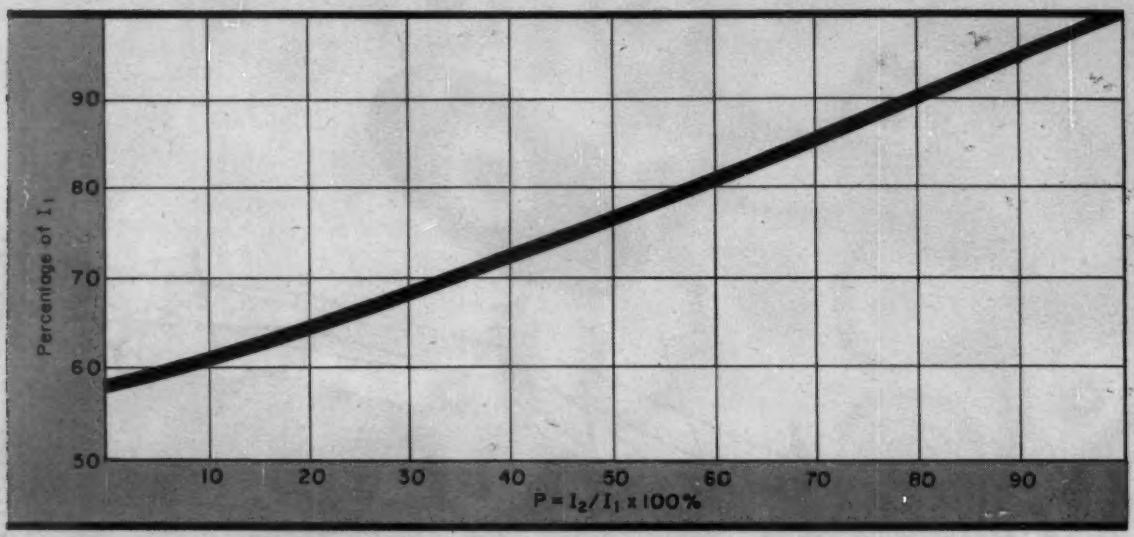
Chart for Estimation of I^2R Losses in Uniformly Loaded Feeder Sections

L. J. RANKINE, Applied Science Division,
International Business Machines, New York, New York



Accompanying curve is useful to make a quick section-by-section evaluation of power losses in distribution feeders. Results determined by the curve will be as accurate as those obtained by a longer load-center method.

To calculate the losses in one section having the same conductor size throughout, ascertain the current entering and leaving the section. Provided the load distribution over the section is fairly uniform, the curve can be used to determine the rms equivalent current value required to calculate I^2R.

Curve is based on the formula

$$I_e = I_1\sqrt{\frac{p^2 + p + 1}{3}}$$

where

I_e = equivalent current for loss calculation purposes
I_1 = current entering section and diminishing uniformly over that section
p = current leaving the section, expressed as a fraction of I_1

Example for Use of Chart

Find: Total I^2R losses in section A-B of radial type residential zone feeder shown in diagram.

Given: A section A-B is 1.6 miles long, has 3 No. 2/0 conductors with R = 0.71 ohms per phase. Assume uniform load distribution on the section.

Solution: Simultaneous current measurements show at point A, $I_1 = 137$, and at point B, $I_2 = 41$ amp.

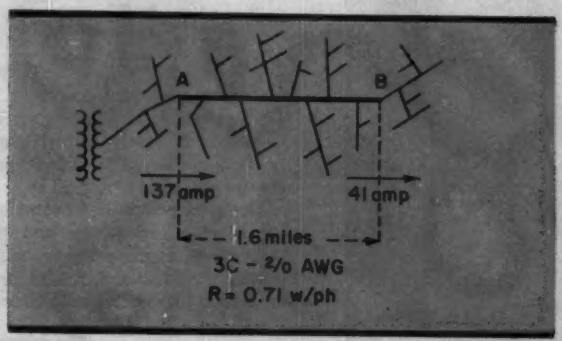
Then $(I_2/I_1) \times 100\% = 41/137 \times 100\% = 30\%$

Enter the graph at 30%, project vertically to curve and read percentage of I_1, or 68%.

Then equivalent current (I_e) for calculating I^2R losses equals 68% of I_1 (137) or 93.2 amp.

Total I^2R losses in 3 conductors in section A-B are:

$(93.2)^2 \times 0.71 \times 3 \times 10^{-3}$



Result: 18.5 kw

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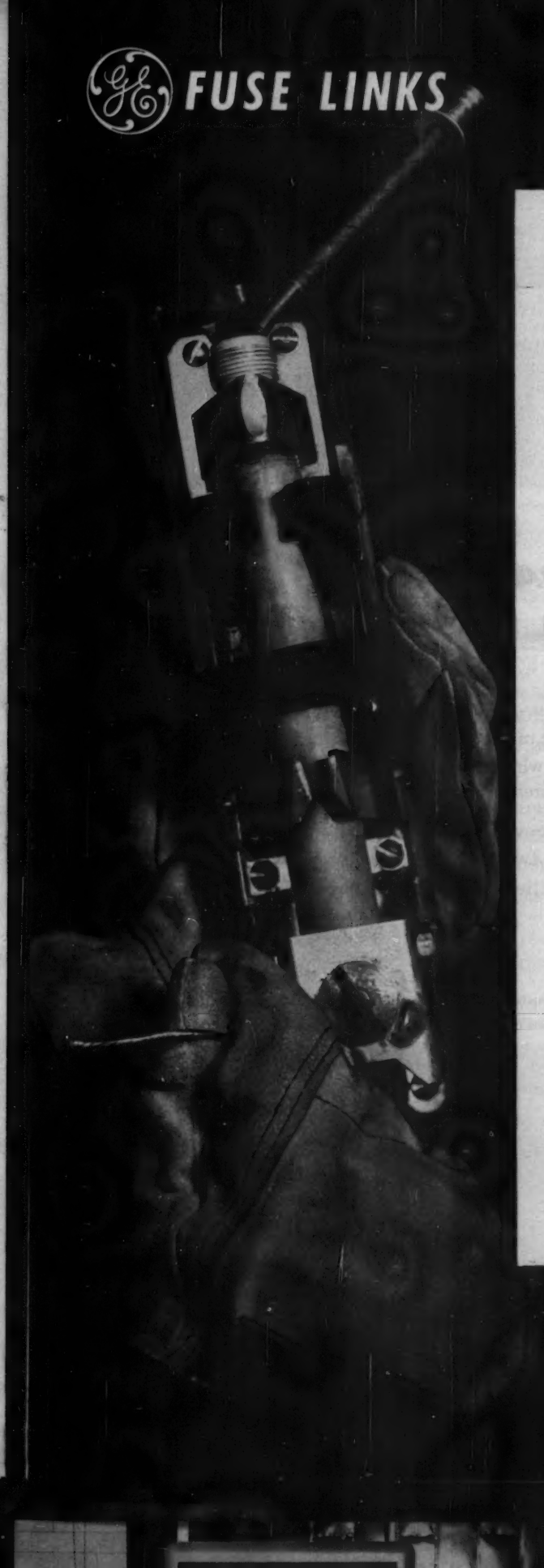
FUSE LINKS



Button cap, special washer
on General Electric Fuse Links

Speed Re-fusing

without special tools—permit replacement in less than a minute

For quick removal of a blown fuse, General Electric fuse links feature a button cap and special washer. The washer's flat undersurface completely seals the upper end of the fuse-holder tube—eliminating the possibility of the cap becoming soldered to the tube by molten fuse metal. The cap can always be removed quickly and easily. No special tools are needed. Re-fusing can be completed in less than a minute.

Fusible element with a low melting point, used in every G-E fuse link, helps protect service continuity and permits better system coordination.

Line Sectionalizing, pioneered by General Electric over 20 years ago, is even more vital today. That is why so much more engineering goes into a fuse link at General Electric than many other products of comparable size.

General Electric fuse links are available in ratings for every system need, including EEI–NEMA Standard "K" and "T," Universal "N" rated and High Surge.

For further information, contact your nearest G-E Apparatus Sales Office, or write for bulletins:
EEI–NEMA links.....GEA-6264
Universal "N" links.....GEA-1994
Hi-Surge links.....GEC-862
General Electric Co., Schenectady 5, New York.

433-17

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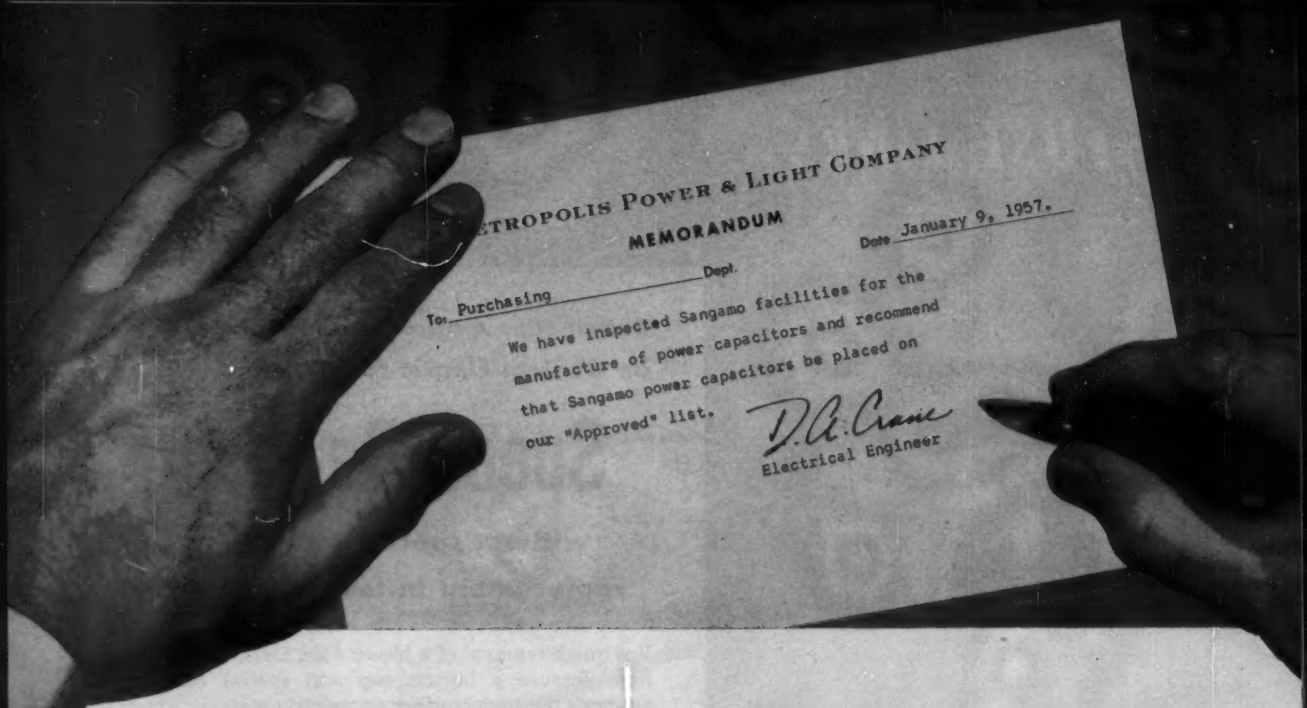

TROPOLIS POWER & LIGHT COMPANY
MEMORANDUM
Date January 9, 1957.
To: Purchasing Dept.
We have inspected Sangamo facilities for the manufacture of power capacitors and recommend that Sangamo power capacitors be placed on our "Approved" list.
D. A. Crane
Electrical Engineer

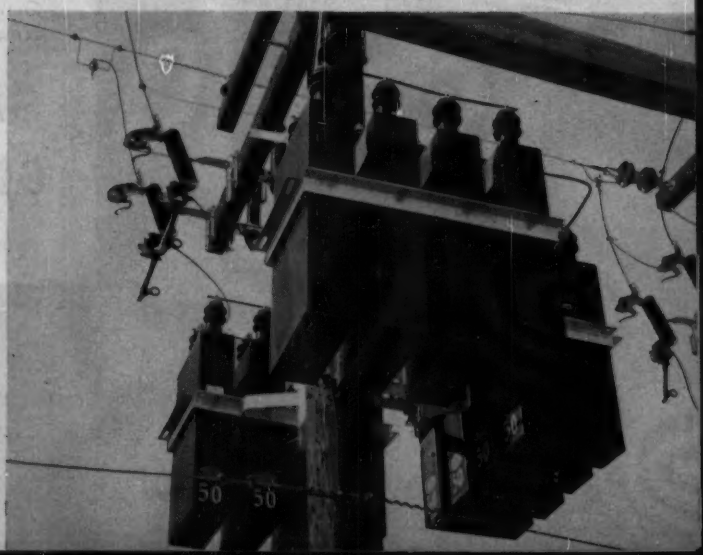
SANGAMO CAPACITORS RATE "APPROVED LIST" of most

PC57-1

Engineers responsible for the purchase of power capacitors want to *know* how capacitors are made, what's inside them, and why they give assurance of meeting specific service requirements.

To provide this information first-hand, Sangamo, over the past two years, has had its power capacitor processing facilities inspected by engineering personnel of many

This cluster mount of twelve Sangamo 50 Kvar Capacitors is part of a bank installed at a substation by a Texas Utility.



Group of engineers inspecting Sangamo manufacturing methods. Here they see how bushings are sealed to case by induction soldering.

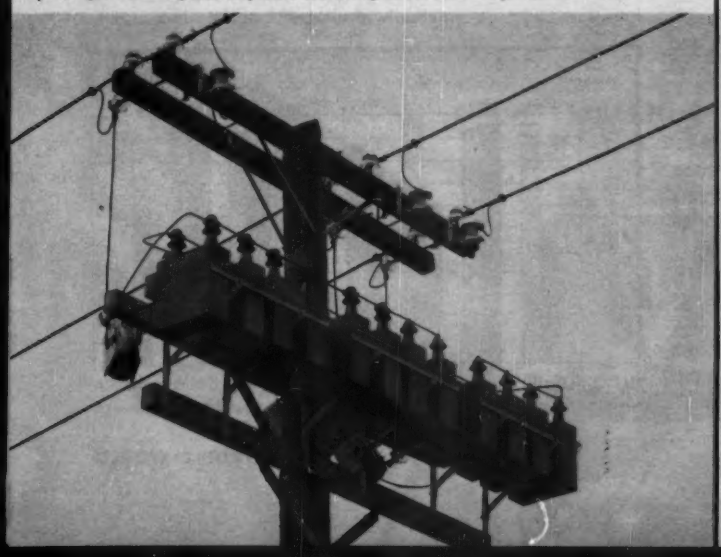
major utilities

major utilities. These engineers have placed Sangamo Power Capacitors on the "Approved List" of their respective companies.

Sangamo invites you, also, to investigate its facilities, inspect its plants, and use its capacitors. Ask your Sangamo Representative, or write us for complete information.

SANGAMO ELECTRIC COMPANY, Springfield, Illinois

Twelve unit in-line Auto Var Capacitor Equipment. Close coupling to pole gives exceptionally low bending moment.



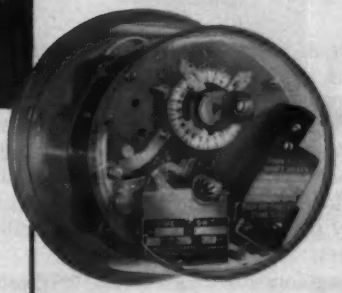
Look to SANGAMO for Capacitor Controls

TO FIT YOUR NEEDS...

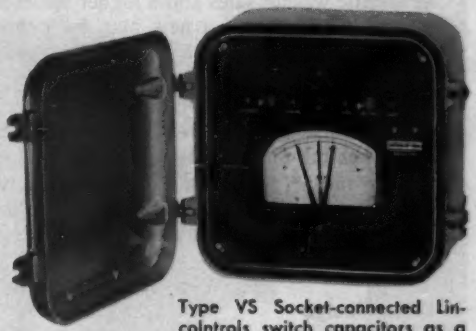
Whether you control capacitor switching as a function of Time, Amperes, Volts, Watts or Vars —Sangamo can furnish economical and reliable control equipment.

Sangamo Time Switches for automatic capacitor switching on predetermined time schedules.

Sangamo Lincolntrols for automatic capacitor switching in response to changes in circuit conditions.



Type WS Synchronous-Carryover Time Switch for socket mounting.



Type VS Socket-connected Lincolntrols switch capacitors as a function of voltage.

Type L Synchronous Time Switch in pressed-steel case with knockouts for conduit connections.

Type AW Synchronous-Carryover Time Switch includes fuse and switches for manual and automatic operation.

'Night Valley' Rate Promotes Water Heaters

- Provides 9-hr daily charging period at 75¢ a month plus ¾¢ per kwhr
- Minimum tank size is 100 gallons
- Maximum heating element is 25 w per gal, 35 w per gal on upper element
- Both customer and company benefit from lower costs, better load

M. W. FRECK and **R. A. MENDENWALD**, Wisconsin Power & Light Co, Madison, Wis.

Wisconsin Power & Light Co has had to face two increasing problems in the handling of its controlled water heating business. (1) The 17 hours of charging time did not always provide an adequate supply of hot water for customers; and (2) Saturation of water heaters was reaching the point at which charging hours would affect system peak load as shown in Fig. 1. These conditions were largely the result of an increased number of automatic washers.

WP&LCo, looking forward a few years to greater automatic washer sales and a higher saturation of water heaters, decided that a new plan for controlled water heating was necessary.

We came up with a special "night valley" rate which requires that the customer have greater hot water storage capacity, but gives him a rate advantage for water heating during the "night valley" hours.

This means that WP&LCo now has two off-peak water heater rates, one with 17-hr-per day charging time; the other with 9-hrs per day charging time. The two rates are:

	17-hr-period	9-hr period
Fixed Charge	75¢	75¢
Energy Charge	1.1¢ kwhr	0.75¢ kwhr

In considering the night valley rate, one question was of principle importance—What combination of tank size, heating element size and charging period was necessary to meet the maximum daily hot water requirements of the average customer? With only night charging, the tank size must be sufficient to hold a day's supply of hot water. With a tank that size, wattages and charging periods could be set to fit the system load curve.

Employees Meter Their Heaters

To answer the tank size question, 86 employees took daily readings on their controlled water heater meters for one month. None of the heaters was equipped with upper or emergency elements. Of the 86 heaters metered, 51 supplied hot water for automatic washers.

Fig 2 shows the results of this test. It gives the relationship between kwhr used on the maximum day and kwhr used during the month. Results indicated that 100-gal and 200-gal heaters having an element

(Continued on page 176)

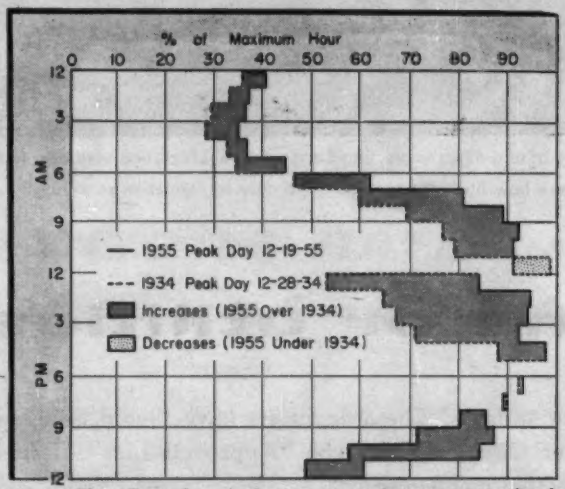


FIG 1—The effect of water heater saturation on system load curve on a typical day in 1955 compared to one in 1934

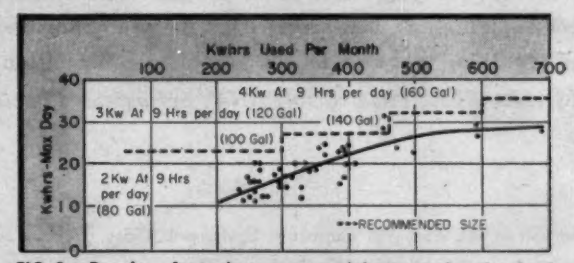

Kwhrs Used Per Month
100 200 300 400 500 600 700
Kwhrs-Max Day
0 10 20 30 40
3 Kw At 9 Hrs per day (120 Gal)
(100 Gal)
4 Kw At 9 Hrs per day (160 Gal)
(140 Gal)
2 Kw At 9 Hrs per day (80 Gal)
RECOMMENDED SIZE

FIG 2—Results of employee-metered heaters showing ratio between kwhr on maximum day and kwhr during month

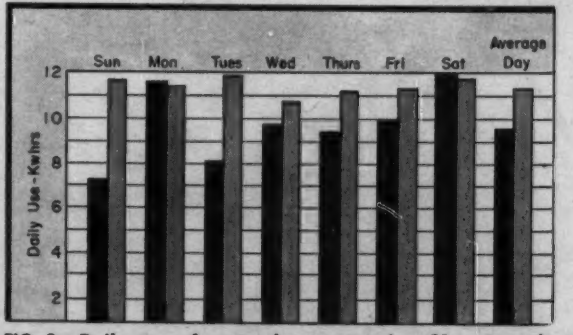
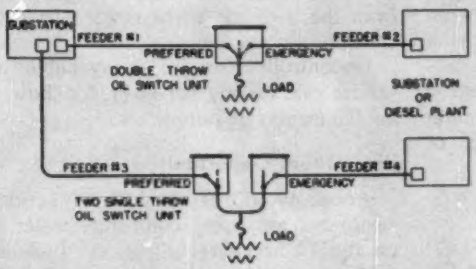


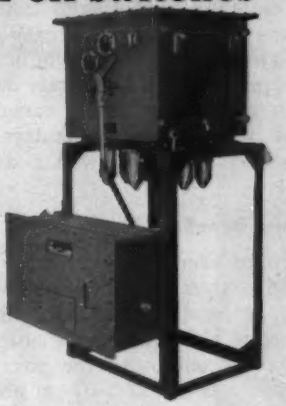
FIG 3—Daily use of water heaters serving 51 automatic washer customers and 35 non-automatic washer customers

INSURE SERVICE CONTINUITY

with G&W Automatic transfer oil switches

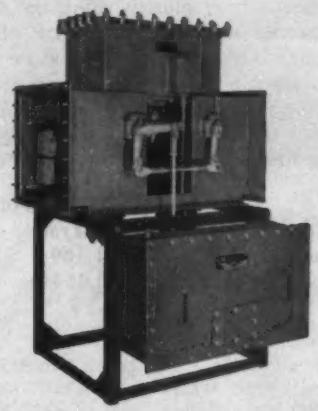


- When preferred feeder voltage fails, the load is automatically transferred to the emergency feeder.
- When preferred feeder voltage is restored (for a period of ¾ minute) the load is automatically returned to the preferred feeder.
- There is no "hunting" on system disturbances. Load cannot be thrown to a "dead" source.
- Model "F6" automatic mechanism provides for remote operator selection of either feeder as the "preferred."

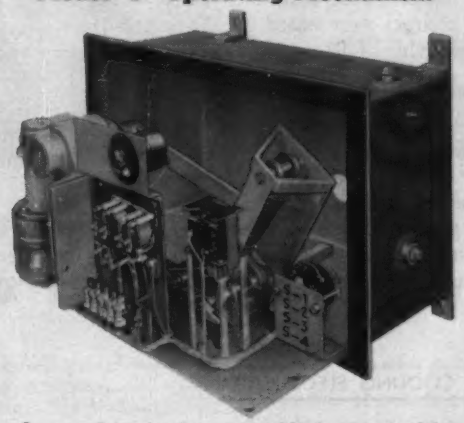


Type "RAD" double throw oil switch unit with Model "F" automatic mechanism.

Model "F" Operating Mechanism



TYPE "DRA" two single throw oil switch unit with Model "F" automatic mechanism. Air filled isolating link box on top.



Improved mechanism removable from watertight case. Motor compresses spring which, when released through action of relays and solenoid, operates the oil switch.

The automatic mechanisms are applied to various forms of Type "RA" oil switches, either for underground cables or overhead connections—up to 23 Kv., 400 amperes. All control wiring is done at the factory. Installation of the unit merely involves connection of the feed and load cables or wires.

Send for Bulletin DA-F which fully describes Model "F" mechanism.

G & W ELECTRIC SPECIALTY CO.

3500 W. 127th St., Blue Island, Ill.

Representatives in principal cities of U. S. A.
Also made in Canada by Powerlite Devices, Ltd.,
Toronto, Montreal & Vancouver

D561

size of 25 w/gal on a 9-hr charging period would meet the hot water requirements of most customers.

The study also disclosed a remarkably even spread of water heating load over the seven days of the week among those customers having automatic washers. Daily use of water heaters serving 51 automatic washer customers and 35 non-automatic washer customers is shown in Fig. 3.

Average daily use serving customers with non-automatic washers varied from a minimum of 7.3 kwhr on Sundays to a maximum of 12.2 kwhr or Saturdays, with a daily average of 9.7 kwhr. Average daily use for customers with automatic washers varied only from a minimum of 10.5 kwhr on Wednesdays to a maximum of 11.9 kwhr on Tuesdays, with a daily average of 11.3 kwhr.

The Customer Benefits

A 0.75¢ rate offers a substantially lower cost, including fixed charges on additional investment in the larger heater required, compared with the 1.1¢ rate for the 17-hr period. For example, a customer using 300 kwhr per month could offset the extra first cost of a 100-gal heater over that of a 67-gal one by savings in the electric bill during the first 47 months, and thereafter save approximately $14.00 a year. For monthly usage of 450 kwhr and a 120-gal heater, the extra first cost above that of an 82-gal unit is recovered in the first 34 months. After that, the yearly saving is $22.98. Fixed charges were based on 3% interest rate and a water heater life of 12 years.

Rate Requirements

The night valley rate is for installations of 100 gal and larger. Lower element sizes may be up to 25 w/gal. The limit for upper or emergency elements, which are not on the night valley rate, is 35 w/gal. The 9-hr charging period permits recovery of about 93% of tank capacity with 25 w/gal; this comes close to its useable capacity.

The rate permits 24-hr heater operation on Saturdays and Sundays, a period during which our system has a light load. A time switch with an omitting device controls the 24-hr operation. Housewives go for this since it gives them an almost unlimited supply of hot water over the weekend.

Except for the 100-gal minimum capacity for the night valley rate, water heater specs are the same for the two rates. This means the customer can change from the 9 to the 17-hr rate, if he needs to, without changing his equipment.

Uncontrolled service is available on the general service rate of 2.3¢ per kwhr, for those having extreme maximum day requirements.

Rate Offers Opportunities

About 49,600 of our 162,000 residential and farm customers are using controlled water heating service on the 17-hr charging period. Including the uncontrolled water heaters, the saturation is about 34%. With the two rates it is expected that the 30% saturation on the 17-hr rate will not increase greatly. The increase is expected on the 9-hr rate; here another 20% saturation could be handled advantageously.

The 9-hr service is intended primarily for families with automatic washers, and with those whose maximum daily usage of hot water does not exceed twice the average usage.

This new service must be sold, and sold judiciously, paying careful attention to the needs of each customer. This demands a well informed and conscientious sales organization and group of dealers in each area.

Results so far have been good. There were 504 customers on the new rate as of Nov. 30, 1956. Sales since the first of the year are reflected below.

	Number of customers	
	17-hr rate	9-hr rate
December 31, 1955	51,169	None
November 30, 1956	53,464	504

HEATING AND COOLING ELECTRICALLY

H & C Show in Chicago, Feb 25 - Mar 1

New products in large numbers are being prepared for display at the 13th International Heating and Air Conditioning Exposition to be held at the International Amphitheatre in Chicago from February 25 through March 1. The American Society of Heating & Air Conditioning Engineers, sponsors of the show, will hold their annual meeting at the same time.

'Custom-Tailored' Units

Information gleaned throughout the industry indicates that the show will feature specific equipment for specific needs. That is, manufacturers, instead of merely showing a line of standard heating, cooling, air conditioning and other units, will provide "tailor-made" equipment, designed to do a specific job in a specific locality with specific weather conditions.

Industry-Wide Problems

Among the industry-wide problems that exhibitors will focus their attention on are: automatic controls for heating and cooling systems; "packaged" units; the quieting of various air-handling systems, especially those that are high pressure and high velocity; the application of aerodynamic principles to air-movement fans; lighter, stronger, more flexible ductwork; new radiators and convectors, with the emphasis on baseboard heating and cooling; ceiling construction that has heating, cooling and acoustical features; electronic air cleaners; and many others.

Another unique exhibit at the show will be a disappearing thermostat. International Expositions Co, New York, is managing the show.

(More Selling on page 178)

How Glass Panel Heat Opens New Opportunities

All over the country, model homes, exhibits and consumer advertising are stirring up tremendous interest in electric heat. With radiant glass panels, you're ready to move in on this new opportunity. It's the kind of heat people like from the start . . . and keep on liking.

Easily expanded. No ducts or burners to install. Just extend the wiring and mount the units.

Maintenance is no problem. No moving parts to wear out. If the glass panel should accidentally break, set in a Blue Ridge Ra-Grid® replacement. There's no expense and mess of ripping out a ceiling, wall or floor.

Look for "Ra-Grid" on each Blue Ridge panel. It's your guarantee of time-tested performance.

Write Dept. 4317 for information and names of manufacturers who supply the finished units.

FACTS ABOUT BLUE RIDGE RA-GRID PANELS

Serviceability—Hundreds of thousands of plates continue to give satisfying service year after year.

Durability—High temper of tough glass is carefully controlled. Offers greater resistance to thermal shock and impact.

Reliability—Blue Ridge is the only manufacturer who makes the glass then fabricates it into the complete heater plate.

Confidence—Best shown by their increasing use each year.

BLUE RIDGE GLASS CORP.

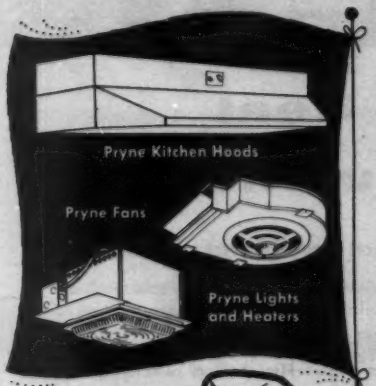
KINGSPORT, TENNESSEE

Creative IDEAS *in Glass*

look to pryne in 1957
rhymes with FINE

...for revolutionary new products for the home!

Great new designs —'sales-engineered' for volume sales! Produced by skilled craftsmen...backed with 33 years of manufacturing 'know-how'!



Before you buy or specify be sure to check how much further ahead you'll be with Pryne Products!

Pryne & Co., Inc. EW-1
P.O. Box 698, Pomona, California
Okay—please keep me posted on Pryne.
Name
Company
Address
City Zone State

LBE Women's Conference Highlights Women in Sales

"Woman, once made equal to man, becomes his superior . . ."
—SOCRATES

The men who run the electrical industry—like men everywhere else —may feel almost anyway they want about women. They may love, hate, admire, or worship them, but one thing is certain: they can't afford to be indifferent to them! This was driven home quite well at the first "Live Better . . . Electrically" Women's Conference held recently in Chicago.

The conference was sponsored by the Home Service Committee of EEI to bring together from all parts of the country women's ideas on how to sell and service other women on the benefits of electrical living.

One of its principle goals was set down as the "coordination of utility, manufacturer, publishing and trade association activities to help the American housewife live better electrically" by R. L. Coe, chairman of EEI's Residential Group, Union Electric Co of St. Louis, Mo.

Approximately 30 speakers addressed the group. They represented EEI, utilities, women's service magazines, manufacturers and trade associations; and their subjects ranged from demonstration ideas to adequate wiring.

(Continued on page 180)

New Spring Appliance Promotion Kit

Pictured above is Look Magazine's spring appliance promotion kit built around the theme, "If It's Electric . . . They'll Love It." Note that kit theme is tied in with LBE theme. Aimed directly at the seasonal gift market, the promotion will stress electrical appliances as gifts for Mother's Day, brides, boy and girl graduates, etc. The kit, which is expected to reach 5,000 retail appliance outlets, contains 27 point-of-sale display pieces and streamers; newspaper mats are available. Kit may be tied in with a box of gladioli bulbs used as a traffic builder.

NEW

HOLOPHANE

Mercury-Vapor

REFRACTOR

No. 4151 ... Designed for

LINE MATERIAL

OVALITE

Luminaire

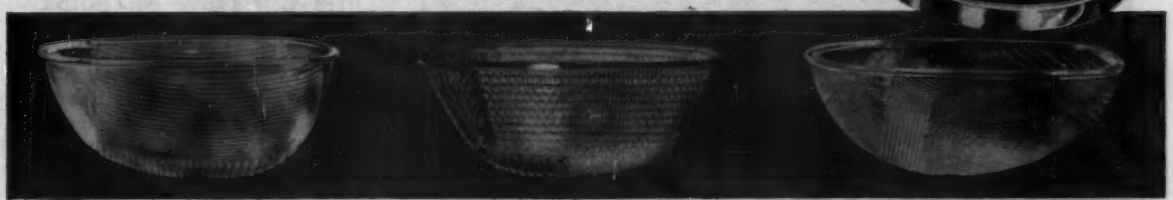
Holophane Street Lighting Refractors Serve Better because They're Made Better...

High-speed pressing is a cost-cutting way of making prismatic glass refractors—acceptable only where high quality is not important . . . This is definitely *not* the Holophane method. We've had six decades of street lighting experience, and we know you can't achieve high precision in prismatic glass refractors by hurried pressing . . . HOLOPHANE REFRACTORS are carefully and individually pressed—one by one—on specialized equipment. Only by this painstaking process can we make prismatic forms accurate enough to direct light exactly where it should go. HOLOPHANE REFRACTORS are the basic components of custom-engineered lighting systems that provide the specific illumination required. They offer finer quality, lifetime durability, consistent performance, and lower operating costs . . .

Holophane Prismatic Design Offers These Advantages

- Concentrates More Light where needed on the roadway
- Distributes Light Uniformly with high pavement brightness
- Gives Greater Visibility Distance —more illumination per dollar

To be sure of quality in Refractors look for the name HOLOPHANE impressed on each piece.



NO. 4035 B-WAY® REFRACTOR FOR WESTINGHOUSE OV-35

NO. 4080 B-WAY® REFRACTOR FOR JOSLYN TYPE MV-111

NO. 4071 VERTILATERAL® B-WAY® REFRACTOR FOR GE FORM 400

Holophane

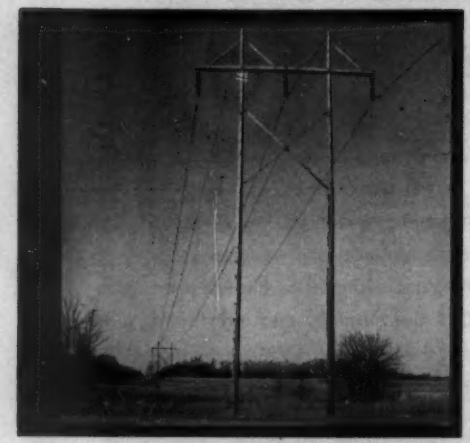
For Better Street Lighting Specify
HOLOPHANE REFRACTORS
®

HOLOPHANE COMPANY, INC.

Lighting Authorities Since 1898 • STREET LIGHTING DEPARTMENT • NEWARK, OHIO

THE HOLOPHANE CO. LTD. 414 KIPLING AVE. SO. TORONTO 14, ONTARIO

GALVANIZED STEEL STRAND



YOUR ASSURANCE OF HIGH QUALITY, LONG LIFE AND LOW COST

Close laboratory control over each step in manufacture has established Crapo Galvanized Steel Strand as a product of highest quality and dependability. You benefit through longer service life and lower ultimate costs.

Heavy, uniform, tightly-bonded coatings of commercially pure zinc, applied by the famous Crapo methods, withstand the punishment of construction, provide maximum resistance to corrosion and contribute to over-all economies.

For OVERHEAD GROUND WIRE . . .
CRAPO Weldless Galvanized Steel Strand

The most practical and economical strand for shielding transmission lines against lightning. Maximum strength and high fatigue endurance, inherent in Crapo Weldless Strand, provide that extra safety factor so important in overhead ground or static wire.

For GUYS and MESSENGER . . .
Crapo Galvanized Steel Strand. Made to highest standard specifications . . . a size and breaking strength to meet all practical needs.

Contact your jobber or write for descriptive folder.

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

LBE Women's Conference

(Continued from page 178)

Helen Kirtland, Supervisor of Women's Interest for LBE, outlined its program for the coming year. The LBE program movement, now just a year old, paid little attention to the role that women might play in it during 1956, but such will not be the case in '57.

Mary Weber, Residential Lighting Specialist at GE's Nela Park in Cleveland, called for more women to enter the home lighting sales field. They need not be engineers to help housewives light their homes more effectively, according to Miss Weber.

"There is a definite place for women in selling home wiring," said Frances Armin, Director of Education and Promotion for the National Adequate Wiring Bureau. "Housewives often prefer talking to another woman about wiring, because they know she will talk in non-technical terms easy to understand."

The importance of the home service woman as a sales power to be reckoned with was hailed on the second day of the conference in a luncheon speech by Edwin Vennard, vice president and director, EEI. His speech, entitled "Home Service and the Power Industry", praised the home service women for the work they've done in bringing the benefits of electrical living to the American home, and called upon them for even greater efforts, not only in the field of electrical living, but in the larger, more encompassing ones of keeping the government out of the power business and American freedom itself.

Little Bill Now on Bulbs

Commonwealth Edison Co is using its "Little Bill" trademark on bulbs and bulb sleeves and cartons in an effort to help its customers to light up for better living. The little bird-bulb, who has been used mainly in advertising since his introduction last year, is working on the utility's light bulb exchange program. Under Commonwealth Ed's residential light bulb service rate, burned out bulbs may be turned in for new ones.

Reliability!

DOSSERT ALUMINUM POWER CONNECTORS

A complete line for substations and generating plants

No single factor is more important in providing reliability of Aluminum connectors than the production of sound aluminum castings with optimum physical properties. These optimum properties provide Dossert Connectors with:

- Greater Corrosion Resistance
- Higher Mechanical Strength
- Higher Impact Resistance
- Greater Conductivity

Incorporation of all these features into Dossert Aluminum Power connectors is made possible by Dossert's own exclusive casting technique. This process was developed after years of experimentation and embodies procedures and controls exceeding aircraft standards. By controlling elements to within close limits, by modifying alloys to put all constituents into complete solution, and by degassing metal to eliminate porosity and internal shrinkage . . . Dossert can offer you a truly reliable connector.

We also welcome inquiries on modifications or applications.

50 YEARS OF TECHNICAL KNOW-HOW

DOSSERT MFG. CORP.

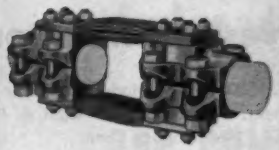
253 Huron Street, Brooklyn 22, N. Y.

Representatives in all principal cities

IN CANADA: W. S. Gerrie & Assoc., Ltd. Toronto

Type CP-AA Straight Coupler

Type TP-AA Terminal

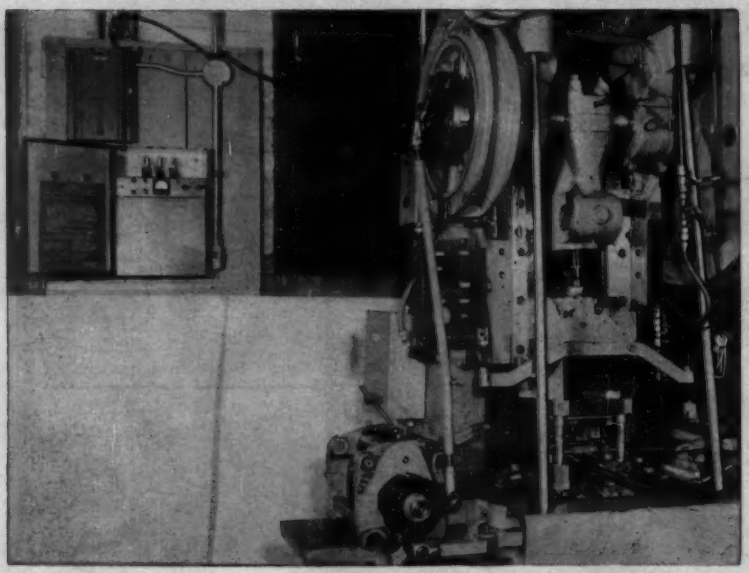


Type XCP-AA Expansion Coupler

Type BP-AA Tee Connector

Type ULKA-AA Terminal

Type PSS-AA Bus Support



ELECTRONIC CONTROL compares net motor current of punch press to preset standard. Responding to slightest overload, it can stop machine or sound alarm

Overload Monitor Saves Press Dies

J. A. KRONER, JR., Industrial Power Engineer, The Connecticut Light & Power Co., New Britain, Conn.

An electronic watchdog, which monitors motor current of a punch press, has recently been installed at the North & Judd Manufacturing Co., New Britain, Conn., to prevent expensive progressive die losses on the machine. Unaffected by power factor or line surges, the monitor responds only to net motor current. Even a slight mechanical overload can be sufficient to stop the press, sound an alarm or initiate any other corrective action desired.

The punch is used to form small metal parts, such as belt buckles, from a continuous metal strip. The progressive dies shape, cut, detach, and eject the parts in one operation. The metal strip serves both as stock and as a conveyor. If the strip breaks or the metal does not eject, damage to the dies and the punch may be serious.

Essentially a feedback mechanism, the automat continuously monitors the total motor current after subtracting the magnetizing current and the core losses, it compares the result with a preset reference which, in turn, is automatically compensated for line voltage variations. The final signal is directly related to the work done by the machine.

Electric Arc Furnace Steel Production Increase Seen

Carbon steel production from electric arc furnaces will increase at the rate of one million tons per year in the next 20 years, according to estimates made at a recent meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers. R. Bry of General Electric's transformer division predicted that by 1975 electric furnaces may produce 25 million tons of carbon steel per year, in addition to an estimated 5 to 6 million tons of alloy steel, all out of the projected increase in total production.

Using a figure of 5 tons of steel per kva, Bry forsees an increase of 200,000 kva per year in furnace transformers for carbon steel alone.

INDUSTRIAL BRIEFS

660-watt strip heaters, installed in the brick press die holders at the General Refractories Co, Orviston, Pa., have boosted the production rate and simultaneously cut the number of rejected bricks. Before the heaters were installed, newly formed bricks often stuck in the die holders, slowing down production while they were removed. The strip heaters, maintaining a steady 80F temperature, insure an easy, clean release for each brick. A total of 8 heaters, operating at 110 v, were installed. A. L. Rozelle, Power Engineer, West Penn Power Co., Bellefonte, Pa.

Auto brake bonding adhesive can be cured and the brake shoes relined in approximately five minutes with the new electric bonding machines installed at the Federal Auto Parts, Baltimore, Md. Because of the big time saving, brake jobs can be done on a "while-you-wait" basis. Each of the four machines is equipped with two 800-w strip heaters, thermostatically regulated at 400F. A 100-lb spring pressure holds the shoes against the heater while the adhesive is cured and the bond formed. Electric timers turn each machine off automatically. I. H. Dixon, Jr, Industrial Power Sales Representative, Baltimore Gas & Electric Co., Baltimore, Md.

Electric space heaters cut both installation and operating costs of a new first aid room in the dry cell plant of the Williamsport Battery Co., Williamsport, Pa. Mounted on the wall of the room, the two 1-kw, thermostatically controlled units do not tie up any valuable floor space. Moreover, they are safe, clean, and well-regulated, all important considerations in a room where steady, comfortable heat and cleanliness are often vital. Cut off from the main work area by partitions, the room had no heat of its own. The alternative was an extension of the steam piping from another area. Power cost is estimated at $100 per year. Harry F. Moore, Power Sales Engineer, Pennsylvania Power & Light Co., Williamsport, Pa.

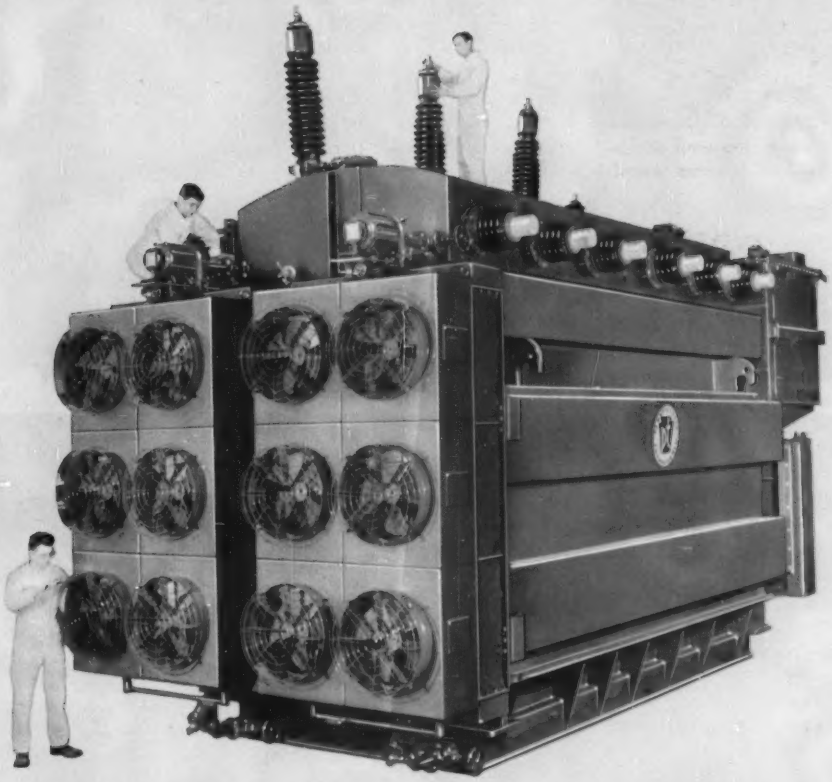
Pennsylvania 260,000 Kva

contour design

shell form

MAIN STEP-UP

Generating Station Transformer



designed and built for upright shipment in one piece

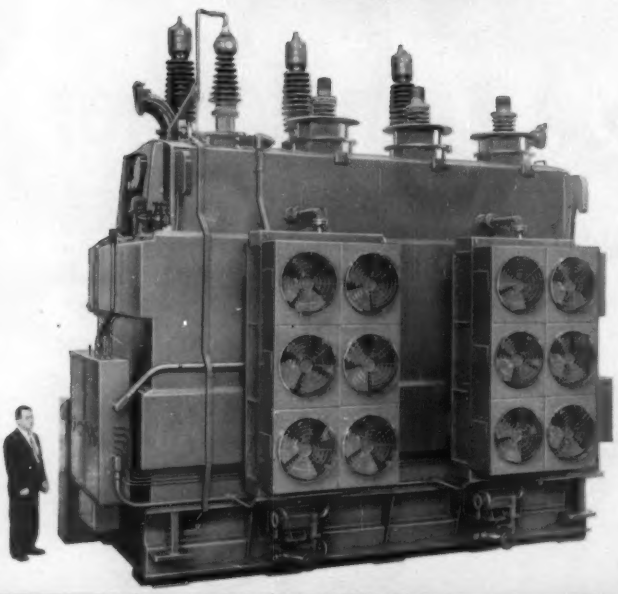
This large three-phase, main step-up generating station transformer was designed and manufactured by Pennsylvania for a midwestern utility. The transformer will step-up a generated voltage of 15,000 volts to a transmission voltage of 141,000 volts. Two low voltage sections of 15,000 volts are rated at 130,000 kva each. Six of Pennsylvania's own Sealmaster Pumps circulate oil through the core and coils and through six coolers. Contour in design, so therefore compact in size, the transformer (less coolers and bushings) was shipped upright in one piece on a depressed center car. A duplicate unit is on order for the same company.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division **CANONSBURG, PA.** Greater Pittsburgh District

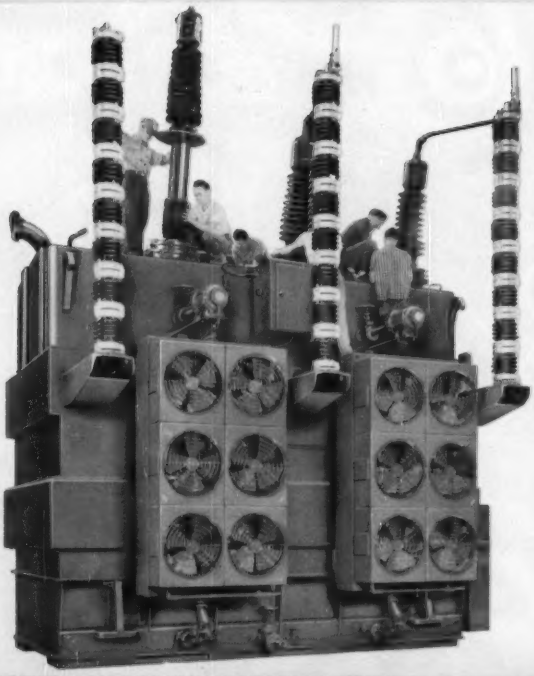
Pioneer in 1-piece upright shipment of large Power Transformers

Main Step-up GENERATING



175,000 Kva

High Voltage: 115,500 Grd. Y volts
Low Voltage: 17,500 Delta volts
Oil-immersed, forced-oil-cooled with forced-air cooler



140,000 Kva

High Voltage: 115,000 Grd. Y volts
Low Voltage: 14,700 Delta Volts
Oil-immersed, forced-oil-cooled with forced-air-cooler

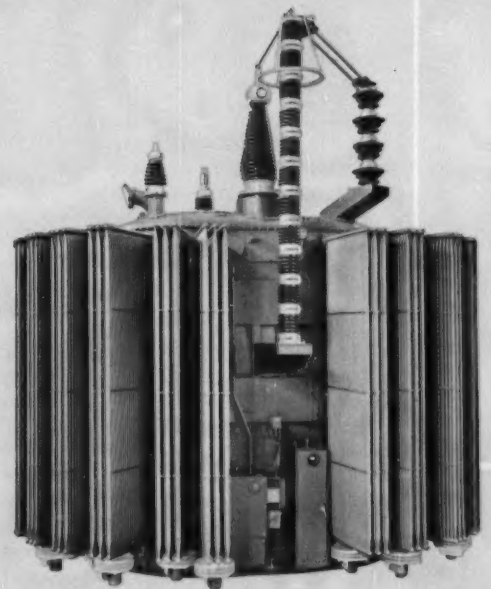
STATION AUXILIARY

Transformers

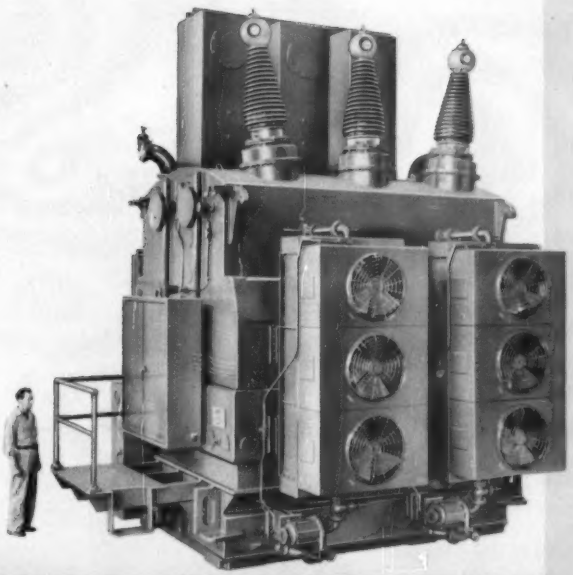
2000 Kva Silicone-Insulated Dry-Type Transformer

Just as Pennsylvania led the way in one-piece shipment of large power transformers, the company also pioneered the development of silicone-insulated units — the fire- and explosion-resistant transformers that are safest of all for both indoor and outdoor installations.

The 2000 kva station auxiliary transformer pictured is a sealed-in nitrogen, dry-type unit; three phase, 60 cycles, 150°C. temperature rise; 2400Δ–480Δ volts.



STATION TRANSFORMERS by PENNSYLVANIA



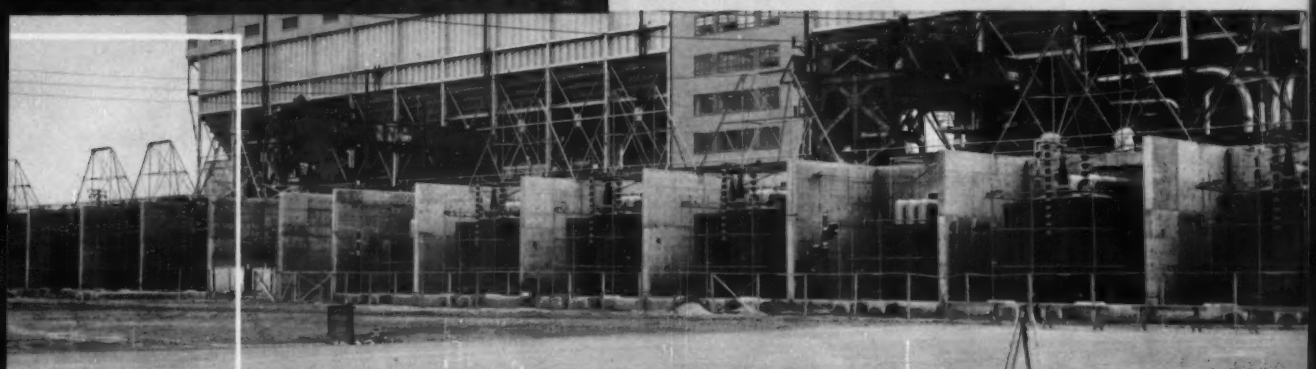
120,000 Kva

High Voltage: 145,000 Grd. Y volts
Low Voltage: 19,800 Delta Volts
Oil-immersed, forced-oil-cooled with forced-air cooler

From the standpoint of kva capacity, the three main step-up transformers pictured at the left can be classified as "large." They range in ratings from 120,000 kva to 175,000 kva. In physical size, however, their dimensions and weights were kept well within the limits for one-piece, upright shipment. This was possible because of the compact characteristics of Pennsylvania's own "contour design," shell form construction.

The units traveled to their respective installation sites in an upright position, with only bushings, cooling equipment and certain accessories removed. This meant easier handling in the field, with greatly reduced installation time and costs.

As the pioneer of one-piece upright shipment of large power transformers, Pennsylvania has long been offering this time-saving, cost-cutting advantage with core form transformers also.



These 19 56,000/70,000 kva main step-up generating station transformers, of core form design, were shipped to their destination in an upright position, completely assembled except for bushings and detachable radiators. Of single-phase construction, these transformers have a high voltage rating of 93,000/161,000 Grd. Y volts with a low voltage rating of 19,000 volts.

PENNSYLVANIA TRANSFORMER COMPANY
A McGraw Electric Company Division **CANONSBURG, PA.** Greater Pittsburgh District

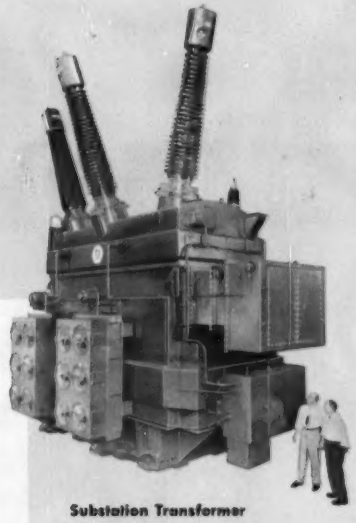
Core form or Shell form

Pennsylvania builds both types of transformers for Generating Station and Substation Service

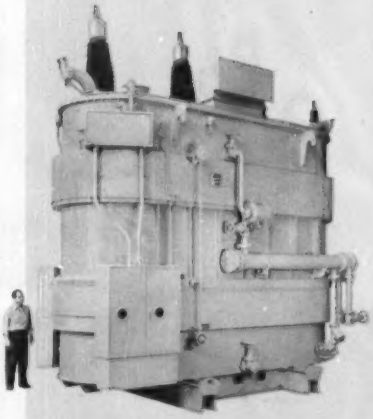
With wide experience in both shell form and core form design, Pennsylvania Transformer engineers are able to provide the transformer that is best suited to every application. Full consideration is given to size and weight, ease of installation, impedance, resistance to short circuit stresses, insulation strength, method of cooling, and other characteristics which result in definite advantages in a given kva and voltage for one design or the other.

Core form or shell form? Why not let the answer for your next transformer be based on Pennsylvania's proved principles of power transformer design?

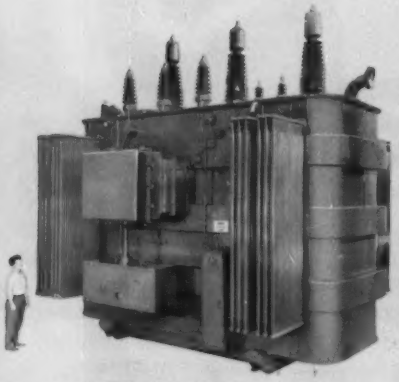
PENNSYLVANIA TRANSFORMER COMPANY
A McGraw Electric Company Division
CANONSBURG, PA. Greater Pittsburgh District



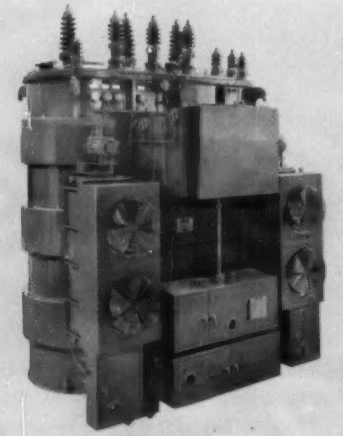
Substation Transformer
100,000 Kva, 3 Phase,
With load tap changing equipment
High Voltage: 330,000 Grd Y volts with ±10% regulation in 32 steps of ⅝%
Low Voltage: 14,400Δ volts



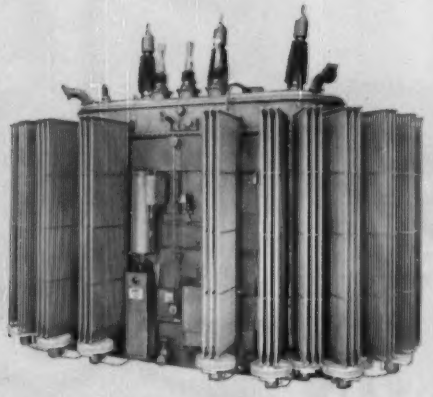
Generating Station Transformer
48,000 Kva, 3 Phase
High Voltage: 115,000 Grd Y volts
Low Voltage: 13,200Δ volts



Substation Transformer
15,000 Kva, 3 Phase, with load tap changing equipment
High Voltage: 154,000Y volts
Low Voltage: 69,000 Grd Y volts with ±10% regulation in 32 steps of ⅝%
Tertiary Voltage: 12,470Δ volts

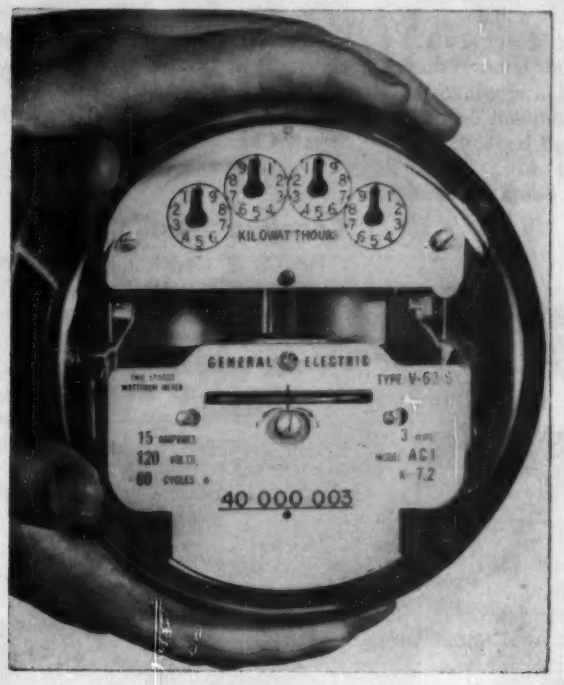


Substation Transformer
30,000 Kva, 3 Phase, with load tap changing equipment
High Voltage: 66,000Y volts, with plus and minus 5% regulation in 32 steps of ⅝%
Low Voltage: 33,000Y volts
Tertiary Voltage: 13,800Δ volts



Generating Station Transformer
56,000/70,000 Kva, 3 Phase
High Voltage: 132,000Y volts
Low Voltage: 15,000Δ volts

NEW EQUIPMENT



Network Meter

This Model V-62 network meter, one of a series of polyphase watthour meters, is available in both Class 100 and Class 200 ratings. Magnetic suspension reportedly eliminates bearing replacement and reduces tilt error revenue losses.

According to the manufacturer, this meter provides accurate registration for circuit variations from 50% to 130% rated voltage. A meter-face screwdriver adjustment can be set to full, lag, or light load to reduce test loss time. Other features reported are ease of assembly, high calibration stability, improved nameplate visibility and interchangeability of registers with present polyphase meters.

Full load speed is 8.33 rpm. Current coil has 60 ampere-turns with a reported maximum temperature rise of 55C at 666.66% rated current.

General Electric Co., Schenectady 5, N. Y.

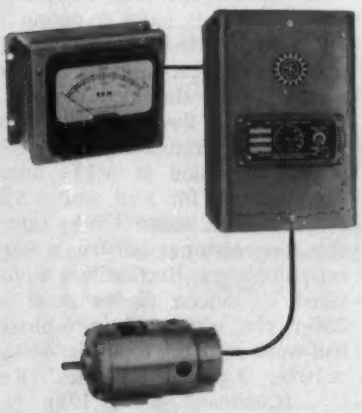
Speed Sensor Relay

This model MEK-2060 speed sensor relay reportedly allows the use of speed as a controlling quantity in such applications as: indicating when zero speed has been reached to provide additional interlocking before releasing an automatic chuck or machine tool; automatically starting a test run when a predetermined speed has been reached; and automatically synchronizing two process machines.

Manufacturer claims repetitive accuracy of speed detection is better than ±2%; calibration accuracy of the dial scales is put at ±5%.

The control unit is available in either open or enclosed NEMA Type 1 forms; other enclosures such as NEMA Type 12 are also available. The units tachometer generator is of totally-enclosed, non-ventilated construction.

Machinery Electrification, Inc, Northboro, Mass.

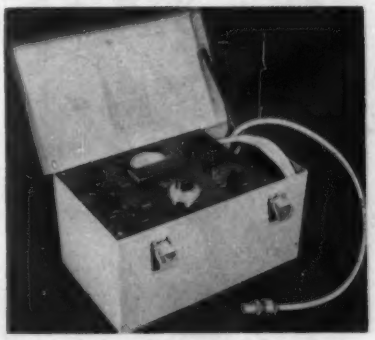


Motor Cleaners

Three Freon nonflammable, selective solvents are reported to remove dirt, oil, and grease without damaging electrical insulation or delicate metal parts. They are claimed to be the least toxic of commonly used nonflammable solvents when properly used. The manufacturer recommends them for cleaning electric motors, and electronic instruments and as additives to more dangerous solvents.

Three different boiling points are available: Freon MF, 75F; Freon BF, 199F; Freon TF, 118F.

E. I. DuPont de Nemours & Co., Wilmington, Del.



Corrosion Meter

The Corrosometer is said to measure metal corrosion directly in increments as low as 0.1 microinch. It is reported to provide direct individual readings in 30 seconds and to determine the effects of process variables or corrosion inhibitors in days rather than weeks or months. The measurement compares the electrical resistance of exposed and protected specimens of the test metals.

Probes of more than 30 metals and alloys are available, with different designs for various pressure and temperature conditions. The probes

NEW

KLEIN

CATALOG

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- INDUSTRY

100 years ago in 1857, Mathias Klein opened a little forge shop in Chicago. Out of this has grown the national institution known as Mathias Klein & Sons.

To dramatize this 100 years of service to industry, Klein has prepared a completely new catalog.

It contains illustrations and descriptions of the wide range of pliers, grips, climbers, belts, safety straps—the tools and equipment needed by linemen, electricians and industry.

A new feature is a section giving the dimensions of each plier—length of handle, length of cutting knives, width of head, size of point, etc.

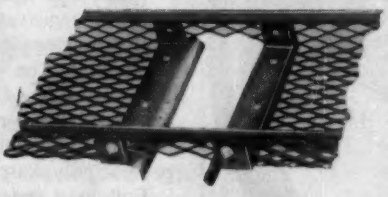
This Klein Catalog No. 100 will be of interest to linemen—electricians—good workmen everywhere. A copy should be in the hands of every purchaser of good tools. Write for yours.

Mathias KLEIN & Sons

are installed or removed during routine system shutdowns and may be several hundred feet from the meter.

The Model C is a battery-operated field unit, the Model K a 115-v ac laboratory and factory model, and the Model R a continuous recording unit. Additional details are given in a 10-page booklet.

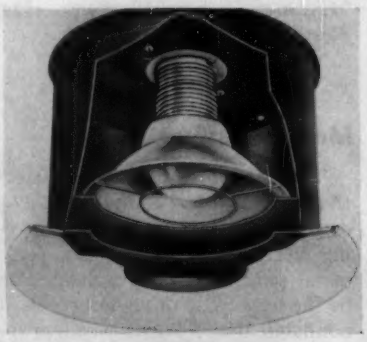
Crest Instrument Co., 11808 S. Bloomfield Ave., Santa Fe Springs, Cal.



Cable Trough Fitting

This cable trough fitting permits drop-outs to be made at any point in the run, in either new or existing systems. After cutting mesh with hack saw or standard air saw, rounded metal strip of fitting are bolted to the trough edges to protect the cable insulation. Side supports strengthen the trough at the cut-out point. Fittings are available in five standard widths, from 6-in. to 24 in.

T. J. Cope, Inc., Third & Walnut Sts., Collegeville, Pa.



Color Spotlight Reflector

Here is a colored aluminum spotlight reflector that is said to provide an almost invisible source of decorative gold, red, blue, or pink light for accent purposes. The reflector is made for the manufacturer's Vari-Spot recessed adjustable downlight for use with a silvered-bowl 100-watt white lamp. Aluminum reflector has a transparent coating. White light is reflected back as the color of the coating. Reported advantages of the unit include a light adjustable to the spot size, and simple replacement of the lamp.

Curtis Lighting, Inc, 6135 W. 65th Street, Chicago 38, Ill.

'Conelrad' Monitor

Here is a "Conelrad" radio alert monitor that requires both a carrier break and a 1,000 cps tone to activate it. The unit is designed to eliminate nuisance alarms caused by carrier breaks alone. It monitors standard broadcast stations for the Conelrad radio alert, which consists basically of two 5-sec carrier breaks followed by a 1,000-cps

tone and a voice message. *FCC regulations require land-mobile radio stations to make provisions for receiving this alert after Jan. 2, 1957.* Unit plugs into any standard 117-v ac outlet. Size is approximately 21 x 9 x 12 in. Weight is about 29 lb.

Motorola, Inc, Communications & Electronics Div, Chicago 51, Ill.

Silicon Rectifier

A silicon rectifier, designated SISRA652000E, has a dc output of 10 to 65 v, 400 to 2,000 amp. It has forced air cooling with fan and silicon diodes shrouded to insure maximum air flow of 1,000 fpm, ambient temperature of 110 F. Reported regulation is ±1% automatic current for load and ±5% ac line charge. Control is by saturable core reactor and high gain magnetic amplifiers. Rectification is provided by silicon diodes rated at 250-v piv, connected in 6-phase, half-wave circuit. Input is 440-v, ±10%, 3-phase, 60-cycles. Re-

(*Continued on page* 191)

WHY BUY LESS THAN YOU ALWAYS GET WITH

FARGO "5000" SERIES

VISE-TYPE CONNECTORS*

TOP EASE and speed of application! Maximum conductivity contacts! Strong, vibration-proof mechanical joints! Ready availability for re-use! You get all these advantages — everything that's important — with Fargo (5000 Series) "One-Piece" Vise-Type Connectors.

These connectors are available in corrosion-resistant bronze and plated bronze. Your distributor can furnish them in all sizes from #8 solid copper to 100 MCM inclusive.

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2 — Insert tap

3 — Tighten bolt

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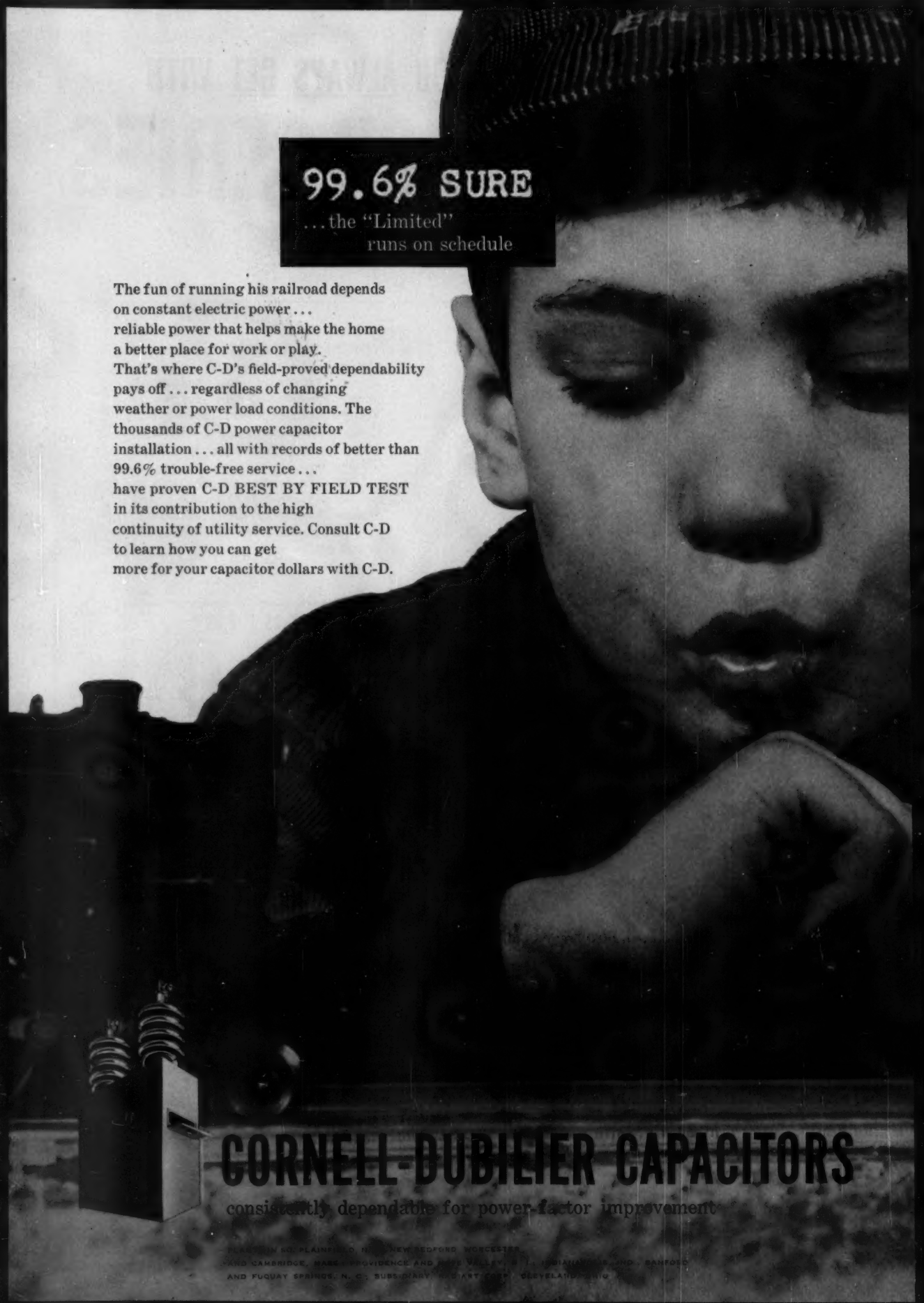
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reliable power that helps make the home
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pays off... regardless of changing
weather or power load conditions. The
thousands of C-D power capacitor
installation... all with records of better than
99.6% trouble-free service...
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in its contribution to the high
continuity of utility service. Consult C-D
to learn how you can get
more for your capacitor dollars with C-D.
CORNELL-DUBILIER CAPACITORS
consistently dependable for power-factor improvement
AND FUQUAY SPRINGS, N. C., SUBSIDIARY

CORNELL-DUBILIER
power-factor capacitors give you better than 99.6% trouble-free service*

C-D's power capacitor's major insulation establishes impulse levels that exceed N. E. M. A. standards. Another feature that results in longer life... less maintenance... fewer dissatisfied power-users, with Cornell-Dubilier capacitors.

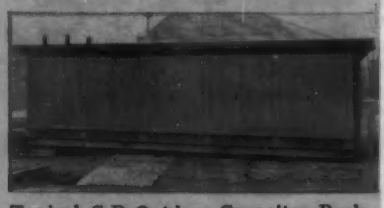
C-D capacitors, although somewhat larger and heavier, have an extra built-in margin of safety to withstand occasional system high harmonic component currents.

Heavy major insulation in the form of laminated liners, with reinforced corners insures highest impulse withstand levels. It means, too, a heavier capacitor unit... because it's a better unit ...but at no extra cost to you. How would you relate a slight increase in weight to years of trouble-free service?

Lowest unit dielectric stress not only provides lowest voltage gradient for steady state operating conditions, but also highest withstand protection against the transients produced by lightning, circuit breaker re-strikes and all other line surges.

Why is it that only C-D power capacitors give you assurance of complete dependability?... because C-D's built-in safety factor results from the ultimate in tried and proven design levels coupled with conservative production techniques and rigorous quality control. For catalog write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

Typical C-D Indoor Capacitor Rack. Rated 150 KVAR; 12 KV.



Typical C-D Outdoor Capacitor Rack shipped completely assembled ready for field energization. Rated 5,400 KVAR; 13.8 KV.

*This is an average based on reports from leading utilities using C-D capacitors. Many of these reports have shown 100% trouble-free service, and none lower than 98.9%.

Silicon Rectifier

(Continued from page 188)

portedly, the new unit can be used an any application requiring continuous 24 hr a day duty, or where constant current is required. Measures 48 in. wide by 60 in. deep by 72 in. high.

Richardson-Allen Corp, 116-15 15th Ave, College Point, N. Y.

Crane Carrier

Compactness, ruggedness and mobility are said to be combined in this specially designed carrier available as an optional with the manufacturer's truck-mounted "Hydra-Lift" crane. The new carrier has a 144-in. wheelbase; driver is said to able to drive and operate boom winch from the same seat, which is of the swivel-type.

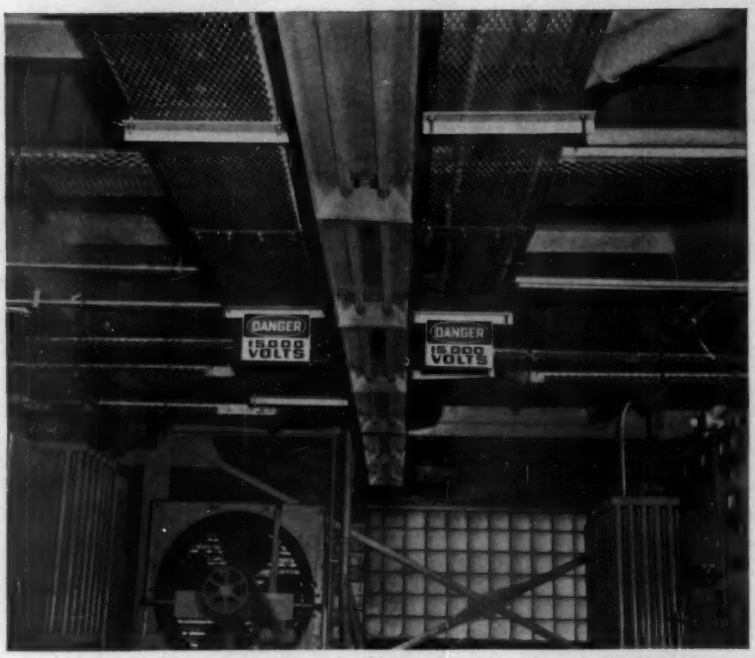
In addition to the carrier, there are several other "optionals" available:

A new higher capacity boom; a hydraulically driven loadline winch; and a boom-tip basket for lifting a man to heights up to 40 ft.

Pitman Mfg Co, 300 West 79th Terrace, Kansas City, Mo.

Totally-Enclosed Motors

A line of totally-enclosed air-over ac motors has been introduced to produce varying horsepower according to the application of varying air velocities. This effect is accomplished by the cooling effect of the air flow over the motor frame created by the fan or blower it powers. Power output can thereby be increased without exceeding the rated temperature rise of the motor. Features of the new line include cast iron ribbed frame construction, double-shielded ball bearings, and "metermatic" lubrication. Leads are numbered and indexed through a neoprene gasket between the frame



Scott Paper Company—Everett, Washington

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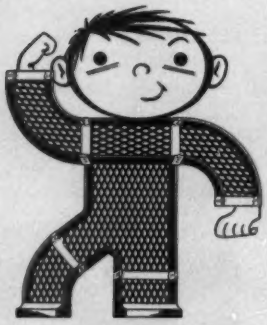
Paper mills are noted for their large use of power. Power engineers in the pulp and paper business know how to conserve materials and still guarantee long, trouble-free service. They can't afford a power breakdown.

More and more consulting engineers are specifying Cope Cable Trough to support power and control cables. Specify Cope on your next job.



Tommy Cope says: "Keep your voltage high with Cope. You'll keep your costs low."

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Our engineers are ready to work with you. Write us today for full details on Cope Cable Supporting Systems.

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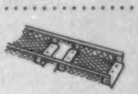
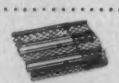

DROP-OUT

CABLE SUPPORTING RISER ELBOW


TROUGH WITH BARRIER STRIPS AND COVER

and the conduit box, with the indexing corresponding to the connection diagram on the nameplate. Available in NEMA frame sizes from ½ through 30 hp. Motors may be operated on 208-v systems. Normally supplied in non-ventilated construction, explosion-proof Class I, Group D and Class II, Groups E, F, and G enclosures are also available.

Reliance Electric & Engineering Co
Cleveland 10, Ohio

Ultrasonic Soldering Iron

This ultrasonic soldering iron is reported capable of soldering aluminum without flux by removing the oxide film on the metal surface. Designated Model No. E 7587 M, the iron uses ultrasonic energy to produce a 'cold boiling" or cavitational effect in the liquid solder, which in turn, is said to agitate and remove the oxide film. Wetting and tinning are then free to take place.

Device has a pistol grip and can be obtained with either a chisel-shaped or tapered copper bit. Power comes from the power unit, which is plugged into an ordinary 115-v, 60-cycle source.

Acoustica Associates, Inc
Glenwood Landing, N. Y.

Phase Distance Relays

A line of two-step, phase distance measuring relays, designated type GYC, is available for utility subtransmission and distribution lines. Each unit contains a mho-type distance measuring device and a time overcurrent relay which may be used independently or together.

The distance measuring relay trips instantaneously for phase

(*Continued on page* 194)

EXTRA MILES...

WITH

PEAK MOBILE RADIO POWER

☆ 100 WATT POWER OUTPUT ☆ MAXIMUM RANGE

☆ EXTENDED COVERAGE ☆ TOP RECEIVER SENSITIVITY

Motorola "TWIN-V" radiophone—with highest power, to push the range of your VHF radio system to its maximum—to optimize mobile-to-base and mobile-to-mobile communications in the farthest fringe areas.

Here peak receiver sensitivity combines with highest transmitter output to assure dependable reception of all communications. Advanced design provides full 100 watt rated output. Yet the economical battery drain is comparable to conventional 60 watt equipment—plus full 6/12 volt interchangeable operation, without changes or modifications, for obsolescence protection in mixed fleets.

The 25-54 mc. 100 watt mobile radio equipment includes all the forward-looking engineering of the "TWIN-V" radiophone line:

- Conservative long-life design
- Reserve performance
- Minimum maintenance requirements
- "On-channel" stability
- Crisp, clear voice reproduction
- Rugged construction
- Dependability through the years

Twin-V 6 12

These and many other features have made "TWIN-V" radiophone the choice of most mobile radio users—features which become more strikingly evident as experience continues to prove their merits.

And Motorola is your complete supplier—with the proper equipment for every radio system, plus parts, maintenance, financing, service and engineering available for every application. Write, phone or wire—TODAY!

MOTOROLA

2-WAY RADIO

MOTOROLA COMMUNICATIONS & ELECTRONICS, INC.
A SUBSIDIARY OF MOTOROLA, INC.
4501 AUGUSTA BOULEVARD • CHICAGO 51, ILLINOIS

Motorola consistently supplies more mobile and portable radio than all others combined.
Proof of acceptance, experience and quality.
The only COMPLETE radio communications service—specialized engineering . . . product . . . customer service . . . parts . . . installation . . . maintenance . . . finance . . . lease.
"The best costs you less—specify Motorola."

YORK-HOOVER

Model YMW–128

RUGGED LINE CONSTRUCTION BODY

Get's the job done

Faster, Better, Safer

Three man integral crew compartment cab is compact, comfortable, well-lighted and ventilated.

"Custom Features" like pull out material drawers with adjustable partitions save operators time.

EXTRA SAVINGS

Extra savings in operators time results from a double drum winch that mechanically operates the derrick which can be placed in the working position in a matter of seconds. Get all the facts about the York-Hoover Model YMW–128 Line Construction Body today! Write to Body Division, York-Hoover Corporation, York, Pa.

YORK-HOOVER
PUBLIC UTILITY BODIES

Phase Distance Relays

(*Continued from page* 192)

faults in the first 90% of the line and is extended to cover the entire line when the time delay expires. It is available with minimum phase-to-neutral values of 0.25, 0.5, 1.0, 2.0, and 3.0, with an easy, tap block setting.

The overcurrent relay can be coordinated with other system relays and is available with inverse, very inverse, or extremely inverse curves. Separate targets indicate instantaneous and delayed tripping. The relay has a dual 125/250-v dc control voltage and can trip two separate breakers.

General Electric Corp., Philadelphia, Pa.

More New Products

Globe Lighting Products, Inc, 2121 S. Main Street, Los Angeles 7, Calif., is marketing a **slotted fluorescent lighting fixture** that is said to allow light to be used that would otherwise be trapped between the lamp and reflector head.

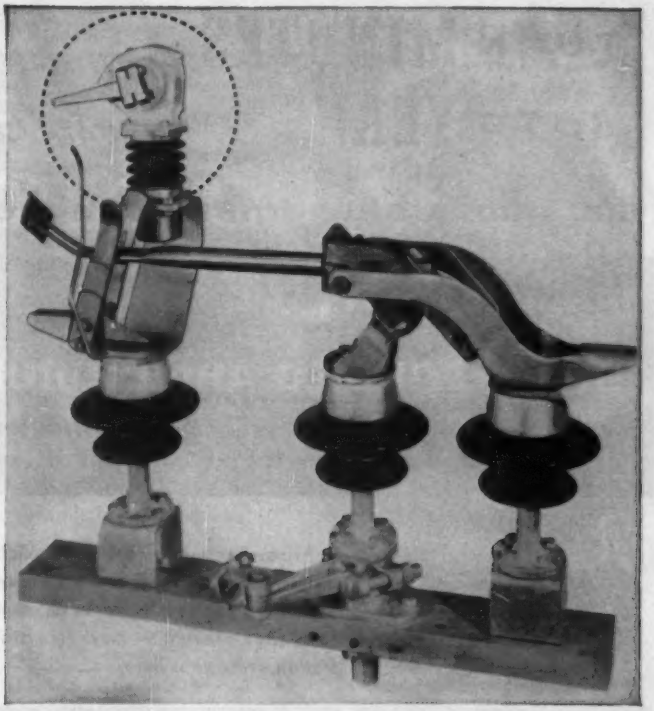
United Electric Controls Co, Watertown 72, Mass., has developed the explosion-proof **pressure-vacuum control,** model J95. The uncalibrated unit is set by means of an internal adjusting nut; its limits are 0 to 500 psi, with a maximum pressure of 600 psi.

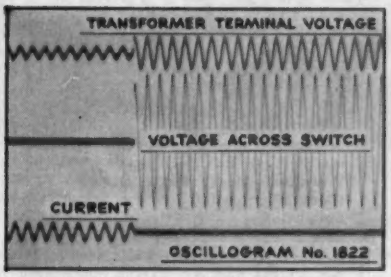
Micro-Switch Division of Minneapolis-Honeywell Regular Co, Freeport, Ill., is marketing a 5-amp, 125/250-v ac **switch** that can be installed in limited-access areas and is actuated by a screwdriver. It is also rated for 3-amp inductive, 30-v dc applications.

Globe Co, 4000 S. Princeton Ave. Chicago 9, Ill., has a heavy duty welded steel **floor grating** called GOLD NUGGET.

Eastern Specialty Co, Philadelphia 40, Pa., has a current **transformer field test set** to check for short circuits, faulty connections, instrument tampering and grounding. Resistance burden spread is as follows: 0.5, 1.0, 2.0 or 4.0 ohms.

Powerupter installed on Delta-Star MK-40 Switch—is actuated by switch blade movement, providing instant circuit interruption without external arc or flame.





Typical oscillogram made during interrupting test of Delta-Star's Powerupter at 15 kv.

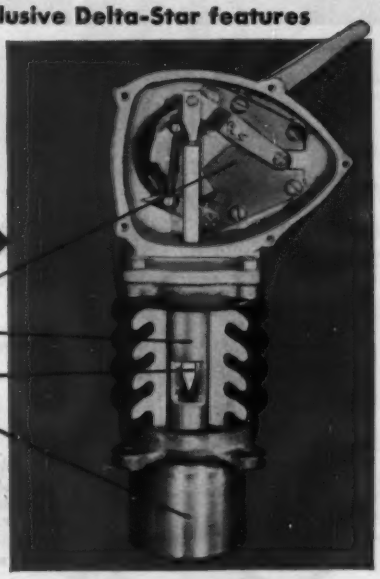
NOW

DELTA-STAR'S New *Powerupter* Switch!

Voltage ratings from 7.5 kv through 34.5 kv—built with exclusive Delta-Star features

This new Delta-Star Powerupter combines a new interrupting device with the most modern disconnecting switches—for interrupting load, magnetizing and charging currents.

The Powerupter features heavy duty construction throughout. Its exclusive automatic trip mechanism provides instant breaking and making speeds independent of switch operation. No feature of Delta-Star switches is sacrificed—every characteristic is retained.



Cutaway view shows *Powerupter* operating advantages

Powerful, high speed mechanism controls speed of Powerupter's operation independently of main switch operating time.

Arcing chamber lined with gas-evolving material. Chamber contains stationary contact and moving contact.

Follower of gas-evolving material confines arc—insuring rapid arc extinction at low current values.

Exhaust chamber provided with muffler—confines and cools exhaust gases released from interrupting chamber.

Ratings: Voltages, 7.5 kv through 34.5 kv; interrupting capacity 600 amp. Continuous current ratings, 400, 600, 1200, 2000 amps.

For all the facts, write Delta-Star or ask your nearby representative. Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton St., Chicago 12, Ill. District offices in principal cities.

HKP

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc. are: Alloy Metal Wire, Connors Steel, Delta-Star Electric, Henry Disston, Laclede-Christy, Leschen Wire Rope, McLain Fire Brick, Quaker Pioneer Rubber, Quaker Rubber, Riverside Metal, Vulcan Crucible Steel, W-S Fittings.

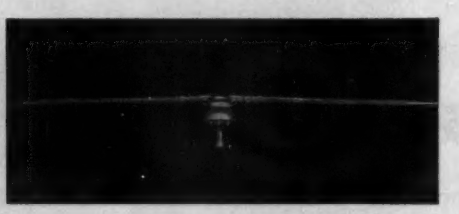
TURN MINUTES INTO YEARS OF *Protection* at the vital points of overhead conductors

FANNER

SUPERFORMED ARMOR RODS

Fine Fanner SUPERFORMED Armor Rods offer the economical way for positive, lasting protection of overhead transmission and distribution lines. Their INSTALLED cost is so small compared with the service failures they prevent, it pays to install them at all points where vibration damage is likely to occur.*

Armor rods are easy to apply.



Completed armor rod installation.

Whenever you need accessory items for overhead conductors you'll do far better by standardizing on fine Fanner SUPERFORMED products. Each product in the Fanner SUPERFORMED line is carefully engineered and accurately manufactured. Highest quality materials provide long service life. Special packaging insures safe delivery and protection in storage. With all their extra features, Fanner SUPERFORMED products cost no more than ordinary products.

Armor rods and other products in the SUPERFORMED line are fully described in current literature. Write today for your copy.

*Where spans are short and tensions low, use Fanner SUPERFORMED lineguards.

Licensed for use under patent No. 2,275,019.

THE FANNER MANUFACTURING CO.

Electrical Products Division

BROOKSIDE PARK • Established 1894 • CLEVELAND 9, OHIO

Telephone: SHadyside 1-6000

Fine Fanner Superformed

AGENTS AND DISTRIBUTORS IN PRINCIPAL CITIES

TAP ARMOR | PLASTIC FANNGUARDS | PATCH RODS | FANNGRIPS

CATALOGS—BULLETINS

• **INDUSTRIAL PERISCOPES:** The manufacturer's line of industrial periscopes for use in industries for the remote observation of inaccessible places or of hazardous processes is illustrated in a 4-page catalog published by Lenox Instrument Co, 2010 Chancellor St, Philadelphia 3, Pa.

• **PULVERIZERS:** Type MB planetary roll and table pulverizers are described in a 4-page brochure issued by Foster Wheeler Corp, 165 Broadway, New York 6, N. Y.

• **POWDERED METAL PARTS:** A comprehensive 2-color brochure on powdered metal parts has been made available by Powdered Metal Parts Division of Lux Clock Mfg Co, 100 Johnson Street, Waterbury, Conn.

• **TIME DELAY RELAYS:** Two bulletins, No. TD404 and No. TD405 concerning its adjustable time delay relays has been published by A. W. Haydon Co, Waterbury, Conn.

• **MISCELLANEOUS:** The publications listed below were issued recently by General Electric Co. The address is Schenectady 5, N. Y., unless otherwise indicated:

Industrial locomotives are the subject of the first of a series of publications entitled, "Six Questions to Ask When Buying an Industrial Locomotive,' to be made available as a guide to purchasers of industrial haulage equipment. Ask for publication No. GEA-6445 from Apparatus Sales Offices.

Outdoor Thermostat Control System is described in a 4-page brochure designated Bulletin GEA-6530.

Heating Furnace Temperature Control is the subject of a 21-page series of six technical articles, No. GER-1206.

Fluorescent lamp ballasts, their prices and data are covered in a 12-page catalog known as publication No. GEC-983-J.

A new air-cooled germanium plating rectifier in ratings from 6 to 24 v, and 750 to 12,000 amp is the subject of Bulletin No. GED 2934.

Voltage regulators are covered in two new bulletins. No. GEA-5752C covers the ML-32 line, and No. GEA 6552 covers the MLT-32 voltage regulator.

Three atomic research reactors now available from GE's Atomic Power Equipment Dept are described in bulletin GEA-6326-B.

Rural package substations—four basic arrangements of them—are covered in a 32-page publication designated GEA-5276C.

Commonwealth Edison Co's Dresden nuclear power plant is described in bulletin GER-1301.

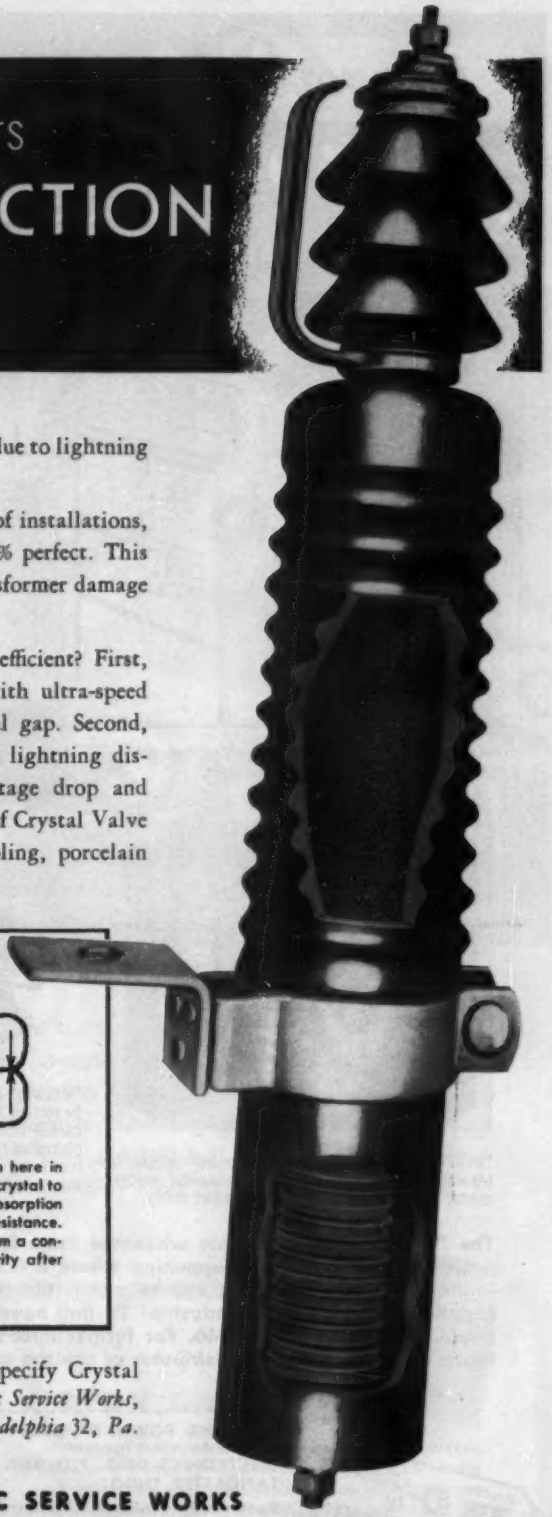
Phenolic molding compounds and resins are the subject of brochure No. CDC-322 available from the Chemical Materials Dept, 1 Plastics Ave, Pittsfield, Mass.

Suspensions insulators of the Ultra High Strength and Extra High Strength types are described in two bulletins, No. TIA-148 (UHS) and TIA-149 (XHS), available from GE's Insulator Dept, P. O. Box 57, Baltimore, Md.

• **HANGERS:** The manufacturer's disconnecting and lowering hangers are covered in an 8-page brochure issued by Thompson Electric Co., Cleveland 14, Ohio.

(*More Catalogs on page* 198)

How Crystal Valve Arresters
INCREASE PROTECTION
against line lockouts

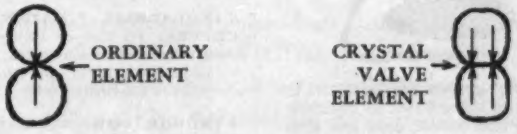


You may readily increase protection against line lockouts due to lightning —simply by using Crystal Valve Arresters.

Results of a 17-year service check, covering thousands of installations, show that Crystal Valve Arresters rated better than 99% perfect. This means virtual elimination of power failures or costly transformer damage due to lightning.

What makes Crystal Valve Arresters so remarkably efficient? First, they provide split-second reaction against lightning, with ultra-speed multiple arcing unit coordinated with isolating external gap. Second, oxidized silicon carbide crystals automatically adjust to lightning discharges—from mild to severe—with minimum IR voltage drop and ample surge voltage reduction. Third, moisture-proofing of Crystal Valve Arresters is complete—with solid brass closed-end coupling, porcelain cap and duplex seal at ground end.

SEE THE DIFFERENCE IN CRYSTAL VALVES



Oxidized silicon carbide crystals in Crystal Valve arresters (shown here in highly magnified form) are shaped to establish multiple contacts from crystal to crystal—instead of single contacts. This means faster, more positive absorption of lightning discharges. At normal voltages, this element has very high resistance. Under lightning surge, the oxidized silicon carbide crystals change from a condition of high resistivity to high conductivity, returning to high resistivity after the surge has passed.

Get the complete benefits of this proved protection. Specify Crystal Valve Arresters for all your power line equipment. *Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc., Philadelphia 32, Pa.*

HKP

ELECTRIC SERVICE WORKS
DELTA-STAR ELECTRIC DIVISION

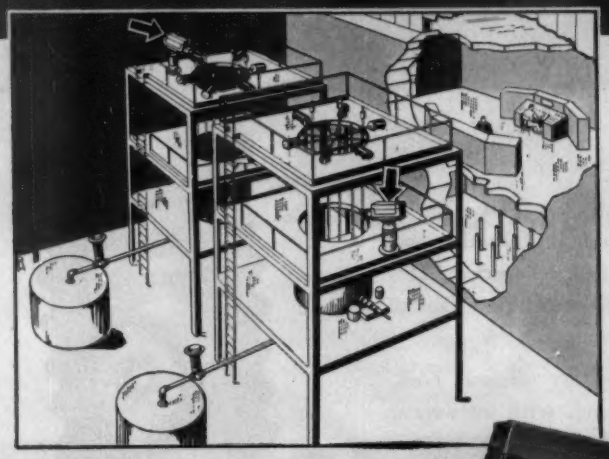
H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc. are: Alloy Metal Wire, Connors Steel, Delta-Star Electric, Henry Disston, Lacledo-Christy, Leschen Wire Rope, McLain Fire Brick, Quaker Pioneer Rubber, Quaker Rubber, Riverside Metal, Vulcan Crucible Steel, W-S Fittings.

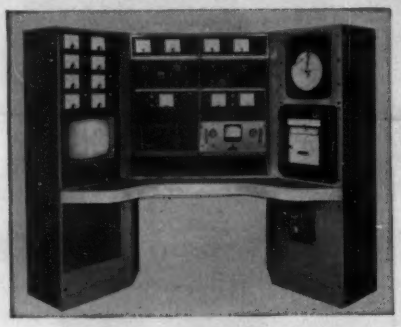
Diamond "UtiliVue"
(WIRED TELEVISION)

used in NUCLEAR REACTOR STUDIES

at Battelle Memorial Institute



Arrows indicate remotely controlled "UtiliVue" Cameras that SEE experimental nuclear reactor cores.



"UtiliVue" Monitor is built into control console in separate control room where experimental nuclear reactor cores can be WATCHED in perfect safety.

"UtiliVue" pedestal enables camera to be rotated 320° and tilted 90° by remote control from console. Zoom lens (also controlled from console) brings objects into focus at widely varying distances from camera.

The "UtiliVue" is invaluable whenever there is the need for actually SEEING what is happening where it is impossible or impractical for the human eye to watch directly. There are installations of Diamond Industrial TV that have been in continuous operation since 1946. For further information, get in touch with your Graybar Distributor or use the coupon below.

7406

Distributed by Graybar Electric Company

DIAMOND POWER SPECIALTY CORP.
"FIRST IN INDUSTRIAL TELEVISION"
ELECTRONICS DEPT., P.O. BOX 57C
LANCASTER, OHIO

Please send me without obligation a copy of new bulletin showing how Diamond Industrial (Wired) Television will help me reduce costs, improve quality, increase sales and aid safety.

Name_____

Title_____

Company_____

Address_____

CATALOGS—BULLETINS

(*Continued from page* 196)

• **MISCELLANEOUS:** The following publications were issued recently by Minneapolis-Honeywell Regulator Co:
From the Industrial Division, Philadelphia 44, Pa.—

Log-N and Period Amplifier is described in Specification S901-6.

"Quik-Konnect" thermocouple components are covered by specification S005-1.

Sorteberg Force Bridge is the subject of Catalog C80-1.
From the Micro-Switch Division at Freeport, Ill.—

The micro-switch for machine tools and other industrial equipment is described in an 8-page brochure, Form No. 84-222.

• **ASBESTOS:** A 4-page brochure describing the operations of its Canadian subsidiary, Lake Asbestos of Quebec, Ltd, has been released by American Smelting & Refining Co, 120 Broadway, New York 5, N. Y.

• **STOCK CATALOG:** A 32-page catalog covering its products available for "immediate shipment" has been published by Fischer & Porter Co., Hatboro, Pa.

• **THERMAL CONDUCTIVITY ANALYZER:** Catalog 56-1008-59 explains the principles, construction, operation and features of both the Condu-Therm Analyzer and the Acratron Electronic Recorder manufactured by Hays Corp, Michigan City, Ind.

• **BORON CARBON PRECISTORS:** Data on construction, characteristics, applications, types, identification, resistance element, terminals, insulation, etc., are given in a 4-page brochure on its precistors issued by International Resistance Co, 401 N. Broad St, Philadelphia 8, Pa.

• **AUTOTRANSFORMERS:** The company's complete line of "Variac" autotransformers are covered in a 24-page bulletin published by General Radio Co, 275 Massachusetts Ave, Cambridge 39, Mass.

• **INDUSTRIAL BALANCING MACHINES:** Its line of "Electronic" industrial balancing machines is the subject of a 16-page bulletin by Stewart-Warner Corp, 1826 Diversey Pkwy, Chicago 14, Ill.

• **INDOOR POWER CENTER TRANSFORMERS:** A line of indoor power center transformers, rated for 300 kva and below, is covered in catalog-bulletin CS-1010, published by Kuhlmann Electric Co, Bay City, Mich.

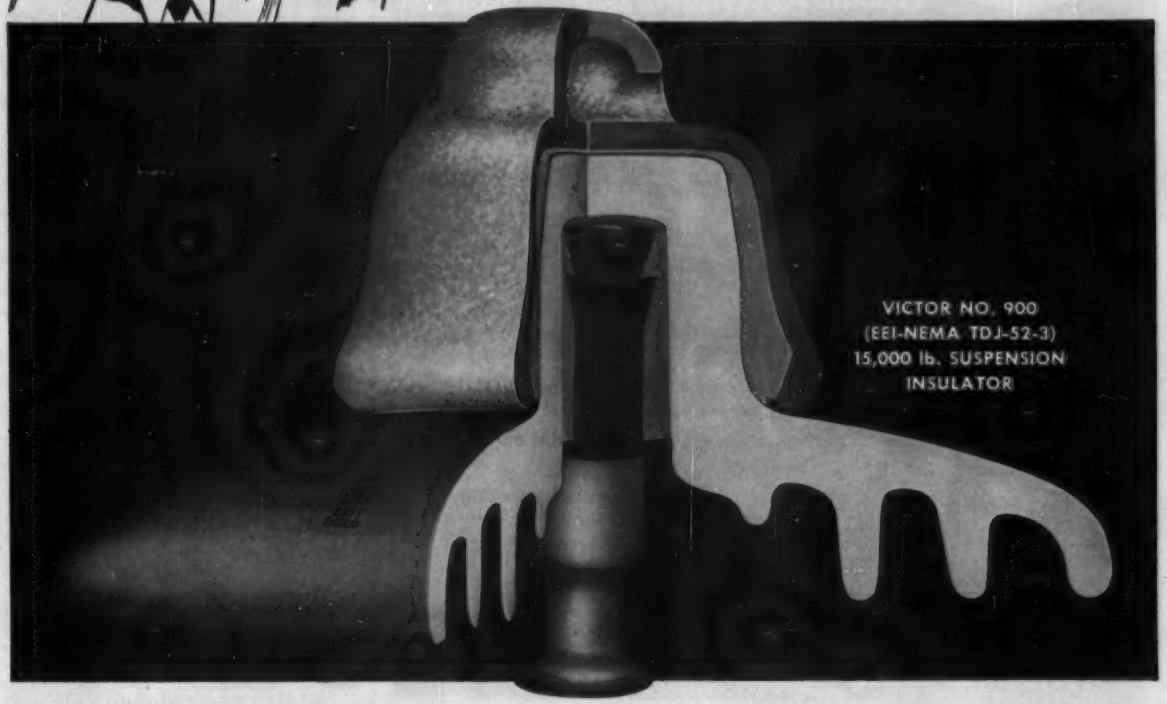
• **CARBON BRUSHES:** A 34-page catalog covers the company's 250 brushes for electric tool motors. Available from Ohio Carbon Co, Dept 78, 12508 Berea Rd, Cleveland 11, Ohio. Ask for Tool Brush Catalog No. 78-C.

• **PUSH BUTTONS:** How to select the right push button for every application is the purpose of a 32-page catalog covering oil-tight and general purpose push buttons, pilot lights and accessories made by Furnas Electric Co, 1026 W. McKee St, Batavia, Ill.

• **RESISTANCE WELDING:** The complete line of Ampco-Weld resistance welding electrodes and accessories is described in Bulletin RW-10, released by Ampco Metal, Inc, 1745 S. 38th St, Milwaukee 46, Wis.

(*More Catalogs on page* 200)

"I'll never replace VICTOR SUSPENSIONS... I just won't live that long!"



Men who purchase insulators are enthusiastic about the service records of VICTOR Suspensions. That's because VICTOR Suspensions are laboratory designed, manufactured under rigid quality controls and tested with the industry's most modern equipment.

Take the No. 900 Insulator shown above, for example. It has rugged, rounded corrugations for maximum strength and resistance to impact. Cap and ball bolt are thick, husky and galvanized to withstand severe service. Scientifically fitted glaze gives added strength and added protection against contamination.

Each insulator is proof-tested mechanically, then subjected to vigorous high frequency and 60-cycle flashover tests. When you buy VICTOR, you just can't buy better suspensions!

New . . . . . .

VICTOR CATALOG

Now ready for distribution is Victor's newest and most extensive catalog. One of the most complete in the field, it includes illustrations and data on many items being produced at VICTOR and not previously shown, up-to-date EEI-NEMA Standards, and an outline of VICTOR'S new plant, research, testing and manufacturing facilities. It's FREE! Write for *your* copy.

VICTOR INSULATORS DIVISION

I-T-E CIRCUIT BREAKER CO., INC.
VICTOR, N. Y.

ALUMINUM
OR GALVANIZED STEEL
SUPPORT SYSTEMS
FOR POWER AND CONTROL CABLES
IN-FREE-AIR
DESIGNED AND DEVELOPED BY HUSKY PRODUCTS

Mr. Contractor...
HUSKY Service Drawings*
cuts down Labor Costs

- We make field erection a simple assembly job.
- We can make take off layouts from drawings furnished by you.
- We eliminate guess work with our service drawings.
- We guarantee our detailed layout on basis of drawings furnished by you.
- NO OTHER MANUFACTURER OFFERS SUCH SERVICE.

ONLY HUSKY OFFERS YOU

★ Detailed Service Drawings
★ Greatest Length
★ Fewer Pieces to Handle

Don't COMPARE MATERIAL COST

Do COMPARE INSTALLED COST

* Small service fee on small jobs. FREE on large jobs.

Design and layout assistance available. Unit responsibility assumed. Over 3000 completed installations — Send for free catalog.

AVAILABLE THROUGH LEADING CABLE MANUFACTURERS

HUSKY PRODUCTS, INC.
5300 VINE STREET, CINCINNATI 17, OHIO

CATALOGS—BULLETINS

(*Continued from page* 198)

● **CONNECTORS:** A "Connector Reference File", designed to present data on electrical connectors in a readily usuable form, is being sent out by Burndy Corp, Norwalk, Conn.

● **GLASS CLOTH:** The company's Stanpreg flame-resistant, epoxy resin preimpregnated cloth is covered in a folder issued by Standard Insulation Co, East Rutherford, N. J.

● **RESISTORS & RHEOSTATS:** Its resistors and rheostats are the subject of a 4-page brochure, Standard Stock Bulletin 53, published by Hardwick-Hindle Co, Inc, 40 Hermon Street, Newark 5, N. J.

● **OUTDOOR LIGHTING:** P & K's Luxaire and Circlelux luminaries, its all-aluminum lighting standards, and its planning and advisory service are covered in a booklet entitled, "Outdoor Lighting", published by Pfaff & Kendall, 84 Foundry Street, Newark 5, N. J.

TECHNICAL LITERATURE

NEMA STANDARDS PUBLICATIONS—More than 150 Standards Publications issued by subdivisions of the National Electrical Manufacturers Association are described in a 17-page booklet now available without charge. The booklet, the first such one produced by NEMA since 1951, is entitled "Your Guide to NEMA Standards Publications." It covers eight classifications: appliances; illuminating equipment; signalling and communication equipment; industrial apparatus; building equipment and supplies; insulating materials; insulated wire and cable; and generation, transmission and distribution equipment. Write National Electrical Manufacturers Association, 155 East 44th Street, New York 17, N. Y.

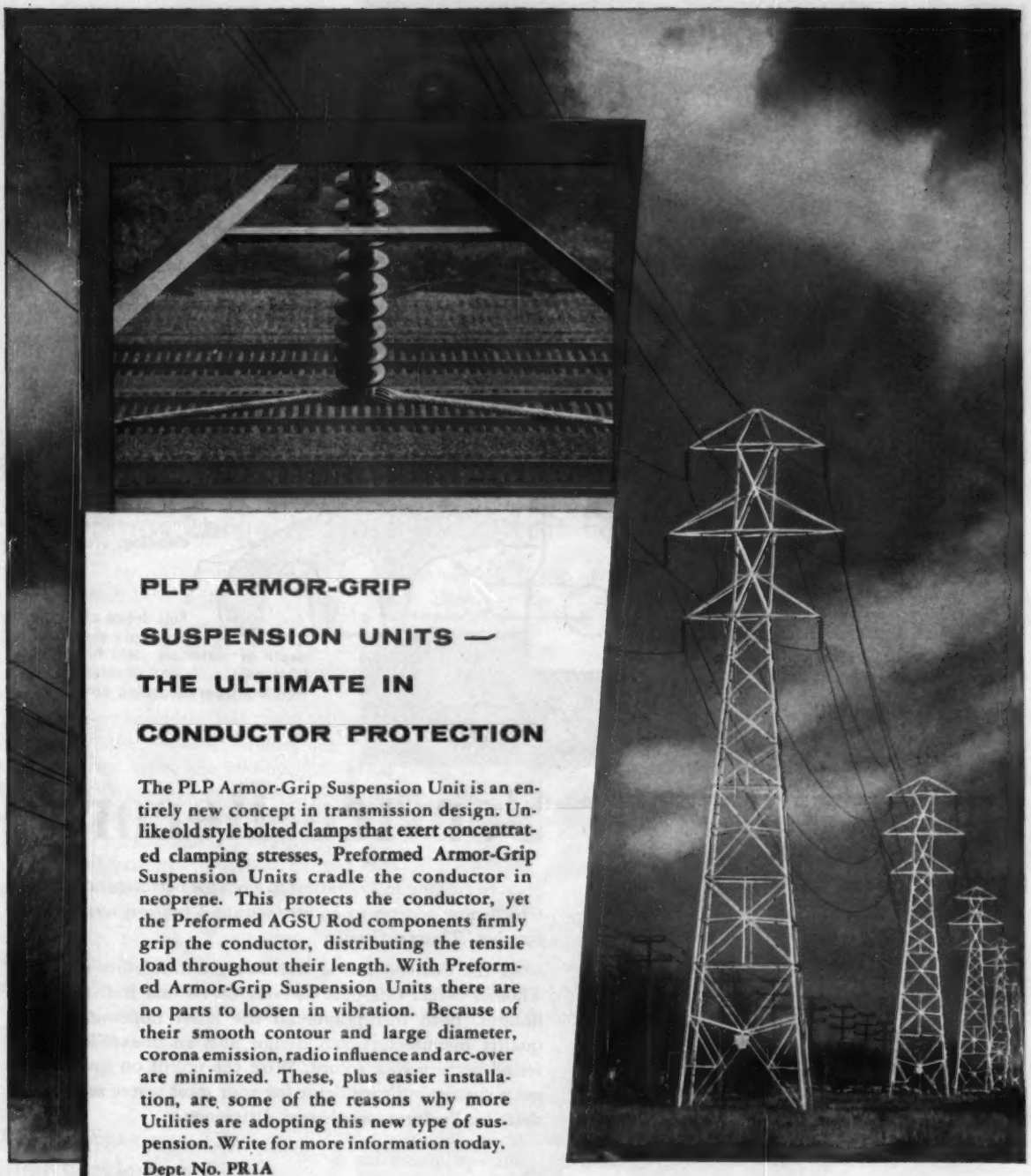
ASTM PUBLICATIONS—The following publications and material have been issued recently by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa:

● Reference Photographs for Magnetic Particle Indications—"Tentative Reference Photographs for Magnetic Particle Indications on Ferrous Castings," (E 125-56T), a set of 47 photographs used to classify discontinuities in iron and steel castings detectable by the dry powder magnetic particle method. Price, $2.50.

● Electrical contacts—"1955 Supplement to the Bibliography and Abstracts on Electrical Contacts," Publication No. 56-J. 48 pages, $1.00.

● Building Codes—"Supplement to 1955 Edition of ASTM Standards in Building Codes", includes revisions and new standards for construction materials that have been accepted since the publication of the 1955 edition. Seven new specifications and two new tests. 224 pages, price $2.75.

● Zinc-Coated Iron & Steel Products—"ASTM Standards on Zinc-Coated Iron & Steel Products (A-5)" presents in a convenient form for reference the various ASTM standards and tentative methods for tests and specifications pertaining to zinc-coated iron and steel products. 21 specs are included; covers wire, strands, fencing, sheets, hardware, terne-alloy-coated sheets and miscellaneous products. 143 pages, $2.25.



PLP ARMOR-GRIP SUSPENSION UNITS — THE ULTIMATE IN CONDUCTOR PROTECTION

The PLP Armor-Grip Suspension Unit is an entirely new concept in transmission design. Unlike old style bolted clamps that exert concentrated clamping stresses, Preformed Armor-Grip Suspension Units cradle the conductor in neoprene. This protects the conductor, yet the Preformed AGSU Rod components firmly grip the conductor, distributing the tensile load throughout their length. With Preformed Armor-Grip Suspension Units there are no parts to loosen in vibration. Because of their smooth contour and large diameter, corona emission, radio influence and arc-over are minimized. These, plus easier installation, are some of the reasons why more Utilities are adopting this new type of suspension. Write for more information today.

Dept. No. PR1A

PX-79

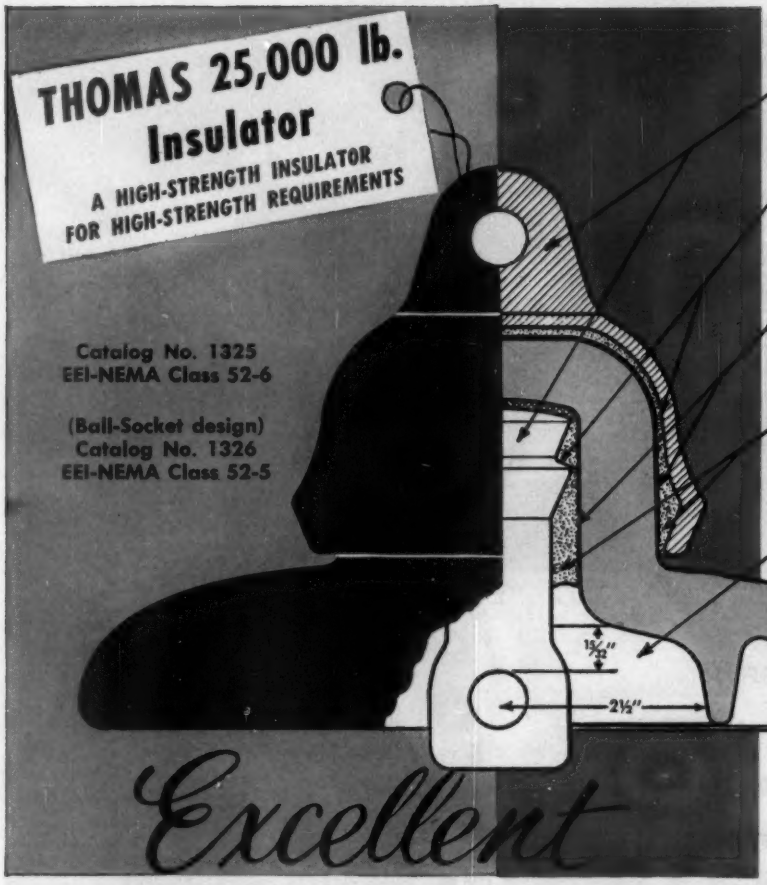
PLP Armor-Grip Suspension Units support these 132 KV Cleveland Electric Illuminating Company lines.

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

Telephone: Cleveland EXpress 1-3571

Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.


THOMAS 25,000 lb.
Insulator
A HIGH-STRENGTH INSULATOR
FOR HIGH-STRENGTH REQUIREMENTS
Catalog No. 1325
EEI-NEMA Class 52-6
(Ball-Socket design)
Catalog No. 1326
EEI-NEMA Class 52-5
High-strength forged steel cap and stud, hot-dip galvanized.
Asphaltic compound treatment of metal and porcelain prevents destructive thermal activity and impact damage.
Special high-strength sanded surfaces provide positive gripping areas for cementing cap and stud to porcelain.
Special Insulator Cement — steam-set under mechanically controlled conditions of temperature and humidity.
Extra large clearance between porcelain and stud facilitates assembly or disassembly, attachment of clamps or fittings, hot-line work, cleaning, etc.
15/32"
2½"
Full droop of porcelain shell and depth of petticoats yield full-value leakage length and greater freedom from cascading arcs.
Excellent

Write for your free copy of
THOMAS EEI-NEMA Standards Bulletin

1873 THOMAS INSULATORS our 83rd year RELIABILITY 1956

"Specify Thomas"— The Best by Line Test

Service Records

... beginning in 1920 attest to enviable performance records which now add up to an astounding *2 million service-years* for this "Thomas Quality" unit.

As the demand for higher strength insulators increases, Thomas offers this unit in both Clevis and Ball & Socket designs. Both incorporate all the latest improvements in quality manufacture and design plus an unexcelled, time-tested performance record. With the accent on quality you get a custom-built insulator for your most severe service . . . there's a Performance-Proved difference.

The R. Thomas and Sons Co.

TX-52

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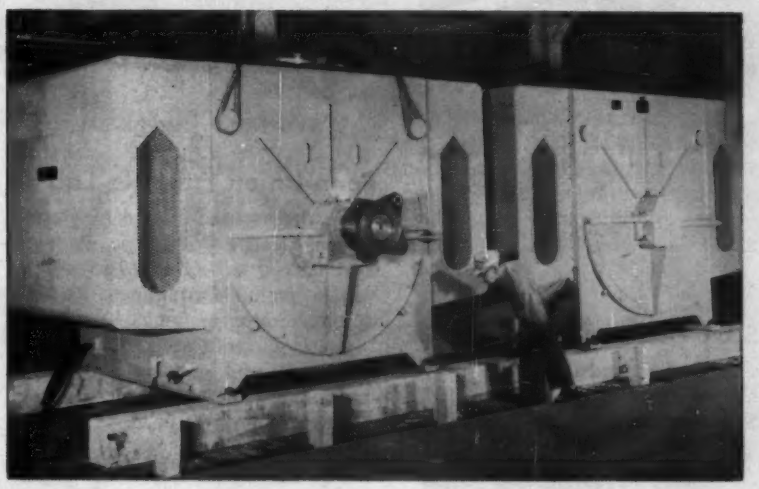


Elliott Ships Large Motors to Detroit Ed

Two 2,500-hp, 600-rpm, weather-protected, induced-draft fan motors are being placed on a flat car for shipment to Detroit Edison Co for River Rouge Station generating unit No. 3. These motors are a product of the Elliott Co, Ridgway, Pa., and are reportedly among the largest ID fan motors manufactured for an electric utility in this country. The motors will be installed outdoors.

Elliott also shipped to this same station the following drip-proof units —two 1,500-hp, 900-rpm motors for FD fans; six 600-hp, 900-rpm motors for coal mills; one 300-hp, 1,800-rpm motor for fire pump; three 200-hp, 3,600-rpm motors for heater drain pumps; three 150-hp, 900-rpm motors for condensate pumps; and two 600-hp, 400-rpm vertical solid-shaft motors for circulating water pumps.

Another shipment will include three 5,000-hp, 3,600-rpm super-quiet motors for boiler feed pump drive.

All of the motors are 4,000-v, squirrel cage induction type (EW Oct 29, 1956, p 148). The horizontal motors have special end brackets for easy access by two maintenance men for inspection of bearings, windings and rotors, blowing out windings and core, and revarnishing of windings if necessary. The vertical motors also have provision for easier access than is normal.

CE 1956 Earnings $2, Order Backlog up 73%

Combustion Engineering Inc, New York, will have net earnings of around $2 per share for 1956, or 12% higher than 1955, reported Joseph V. Santry, board chairman, before the New York Society of Security Analysts.

Orders received during 1956 totalled approximately $325 million. Backlog as of December 31, 1956, was about $375 million, up 73% over $216 million in 1955. Present volume of unfilled orders should assure operations at a high level for the next two years.

About 10 million kw of generating capacity was represented by the boiler contracts received from utilities last year. This was 50% over the peak year of 1955. Santry said that for four years over 7 million kw of new business was "controlled circulation" boilers, half of which was for 2400 psi.

In the nuclear field, Santry said that a continuing volume of work was under fabrication.

Beth Steel Develops Al-Coated Pole Hardware

A method of aluminum coating of steel pole hardware, reported to be practical and inexpensive, has been developed by Bethlehem Steel Co, Bethlehem, Pa.

The new technique, which Bethlehem has been working on for 2½ years, consists in its broader aspects of cleaning the steel surface in a fused salt, followed by preheating in a fused salt flux and dipping in molten aluminum. Bolts as small as 3/16 in. in diameter have been coated and their threads spun clean. Present conditions limit maximum size of steel product to be coated to 38 in.

The company believes the new process will make commercially available corrosion-resistant steel pole hardware that will last the expected life of today's preservative-treated wood poles—25 to 30 years.

GE and PSE&G Mark 100th Industrial Forum

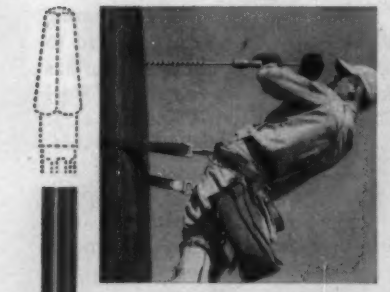
Over 400 engineers and plant managers, representing a cross-section of industrial New Jersey, heard industry and utility specialists predict that:

1. By 1976 virtually all U.S. plants will be air conditioned;
2. Automation will include "computers which both calculate and help eliminate costly communications barriers between engineering concept and finished product . . .";
3. "Slow-scan", a new closed-circuit television technique that will be practical for industrial purposes and is predicted for televised telephone calls in homes within a few years;
4. By bombardment with high-energy electrons, plastics may be improved, drugs may be sterilized, and more than 40 foods, including meats will be sterilized and kept preserved without refrigeration.

These and other forecasts were revealed to area industrial managers at a one-day productivity forum cosponsored by Public Service Electric & Gas Co and General Electric Co. The forum, held in Newark,

New adapter shank bit

fits either hand brace or power drill



Taper square shank fits hand braces

Cut off taper and use "hex" shank in both power drills and hand braces

Cut your wood bit inventory by 50%

Now you can eliminate the need to stock two types of wood auger bits. Irwin's new Adapter Shank Bit fits both hand braces and power drills.

With hand braces, use the Adapter Shank Bit as it comes. Cut off taper square and the Adapter Shank, with its 6 "hex flats", chucks perfectly in power drills or hand braces, either one. No wobble, no run-out. Clean, efficient cutting action. Reduces inventory and record keeping by 50%. Saves time on the job, too. Call your distributor, or write today for complete information. Sizes 4/16 to 17/16 inches.

***All Irwin Adapter Shank Wood Bits** are forged in one piece from special steel and heat tempered full length for longer life. Plastic coating on balanced cutting heads guarantees factory-fresh sharpness, unequalled performance. Widely used by utilities, electricians and construction workers.*

IRWIN auger bits • screw drivers

Wilmington, Ohio

N. J., was the 100th in a continuing series held in cooperation with the nation's utilities as part of GE's "More Power to America" program. Public Service also co-sponsored the first forum which was held in Newark in 1951.

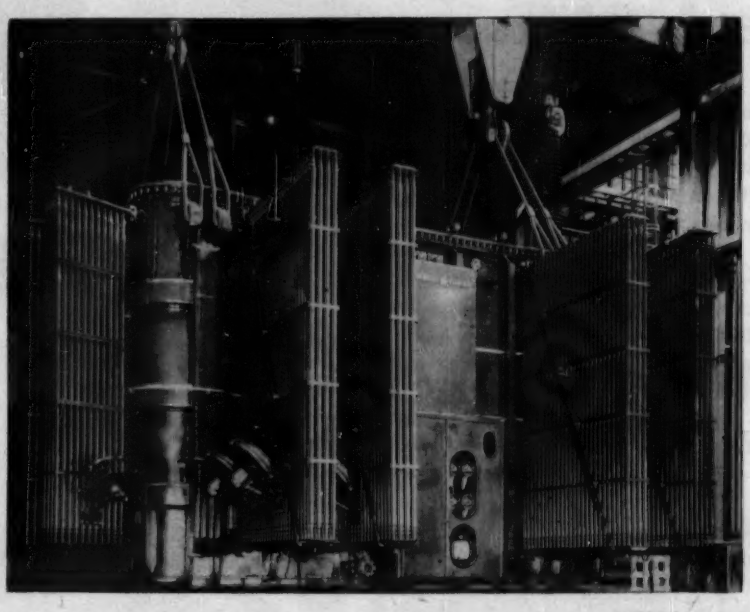
More than 20,000 industry representatives in 31 states have been kept abreast of the latest production techniques through attending the forum, according to a GE spokesman.

Six-Generator Award to GE

The Portland District of the Corps of Engineers has awarded a $9.6-million contract to General Electric Co, bidding from Portland, Ore., for furnishing and installing six 82,105-kva main generators for the Dalles Dam power house. These are generator units No. 9 to 14. Work must be completed by November of 1960.

Penn-Union Enlarges Lab

Work has been started by Penn-Union Electric Corp, Erie, Pa., on an enlarged test laboratory. Here will be included equipment for the automatic programming of temperature and current tests for evaluating aluminum and copper connectors under load conditions. Resistances to one millionth of an ohm will be



Big Autotransformers Shipped to BPA

The last of six single-phase autotransformers, largest built to-date by General Electric Co, was shipped recently from the Power Transformer Department at Pittsfield, Mass.

Each of the big units, rated 200,000 kva and weighing 205 tons, was built with a one-piece tank and transported up-right. They will be used to step the voltage up and down between 345 kv and 230 kv on the Bonneville Power Administration system in the Pacific Northwest states. Thyrite resistors help protect the autotransformers from high voltage lightning and switching surges.

The BPA autotransformers were designed with the aid of a card program calculator and an electromagnetic model to help determine the best arrangement of core steel, copper windings, insulating and cooling elements.

Each autotransformer is cooled by its insulating oil, which circulates by convection through external radiators. Two banks of fans blow air through the radiators to increase the cooling capacity.

measured. Salt spray, vibration, and tensile equipment are included for testing performance of conductor fittings. The laboratory is scheduled for completion in February.

SMS Awarded Contract for Rocky Reach Turbines

An order for hydraulic turbines valued at well over $11 million has been awarded to S. Morgan Smith Co of York, Pa., by the Public Utility District No 1 of Chelan County, Washington. The contract includes seven 140,000-hp Smith-Kaplan turbines with governors, to be installed in the Rocky Reach Hydro-Electric Power Project on the Columbia River. This is the largest single order received to-date by the York firm.

The site of the plant is about nine miles north of Wenatchee, Wash., and is immediately downstream from the Chief Joseph Power Project for which S. Morgan Smith is currently constructing six 100,000-hp vertical Smith-Francis type turbine units.

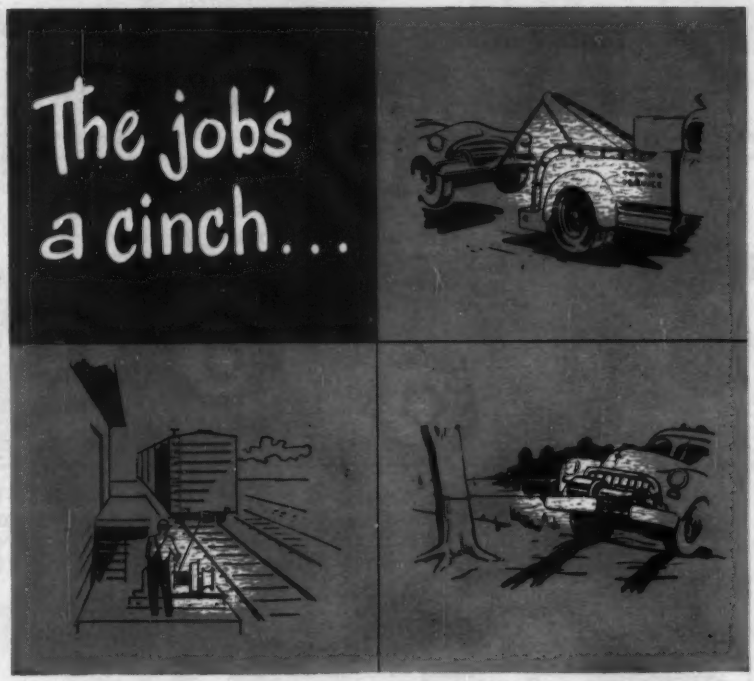
The 280-in. runners of the Rocky Reach units will be installed vertically in concrete spiral cases and will operate at 90 rpm under a rated head of 92 ft. Shipments are scheduled to begin with the embedded parts during the summer of 1959 and will be completed about two years later.

Westinghouse Electric Corp was low bidder at $18,337,010 on the seven 107,000 kva generators for the Rocky Reach power project.

M&M BRIEFS

S&C Electric Co, Chicago, has formed a Western Sales Division. It will be located in the San Francisco area. R. W. Hutchinson will head the division.

Leeds & Northrup Co, Philadelphia, Pa., has a flue gas monitoring system which is said to assure peak combustion and to bring greater fuel economy. This central system has four components: One or more probes for gas sampling; a gas cleaning unit for each probe; magnetic type O_2 analyzer assembly; and electronic recorder—controller for O_2.



with a GarWood winch!

You can depend on Gar Wood winches to handle any application with speed, ease and safety. That's because you get more than just a rating when you specify Gar Wood! You also get a bonus of advanced features unmatched by any other make. Here's how you benefit:

1 DEPENDABLE OPERATION
On Gar Wood winches the clutch is completely enclosed. Since dirt and weather can't get in, the clutch can't stick, rust or freeze . . . ever!

2 GREATER SAFETY
Self-energizing safety brake automatically holds any load up to rating. Back-draft-type clutch can't slip even when only partially engaged. Hexagonal shaft locks control levers in place.

3 LESS MAINTENANCE
Rust- and corrosion-proof heavy-section aluminum housings enclose all moving parts in an oil bath. Ball-bearing worm shaft, bonded brake linings and heat-treated drum shaft assure a long, trouble-free service life.

Check Gar Wood's famous line of truck and stationary winches in ratings from 7,000 to 100,000 pounds. Contact your Gar Wood-St. Paul truck equipment distributor, or mail coupon below.

GAR WOOD INDUSTRIES, INC.

Wayne, Michigan • Richmond, California

MAIL FOR SPECIFICATIONS

CUSTOMER SERVICE DEPARTMENT EW-1
Gar Wood Industries, Inc., Wayne, Michigan

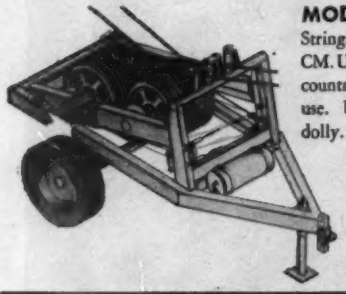
Please send me specifications on Gar Wood winches.

*Name*_____
*Title*_____
*Company*_____
*Address*_____

Partial showing of the now ***COMPLETE*** line of . . .

PENGO TENSION WIRE STRINGING EQUIPMENT

Manufactured by **PETERSEN ENGINEERING CO.,** ***Santa Clara, Calif.*** **14 Patents Pending**

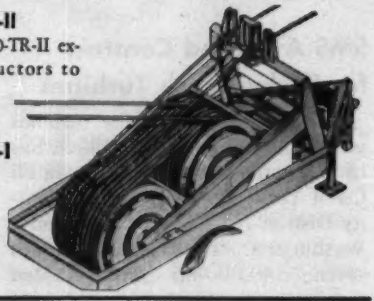


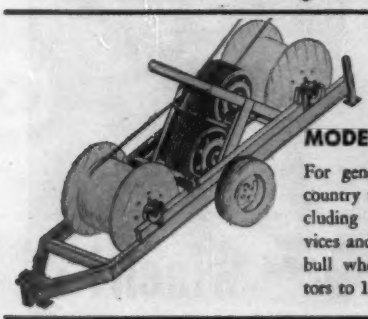
MODEL 5000-TR-II
Strings two conductors to 556,300 CM. Used primarily for very rough country work; also for general use. Use separate reel-carrying dolly.

MODEL 5000-TR-I
Similar except strings one conductor.

MODEL 6000-TR-II
Similar to Model 5000-TR-II except larger. Conductors to 1,272,000 CM.

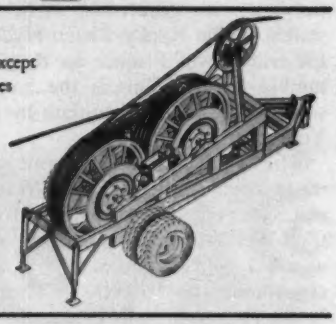
MODEL 6000-TR-I
Similar except for one conductor.

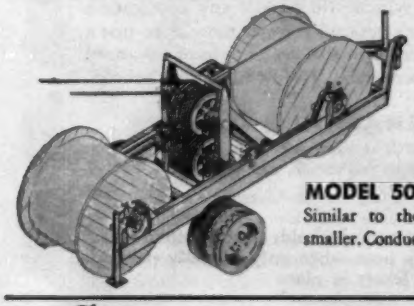




MODEL 6000-WS-TR
For general and medium rough country use. A complete unit including trailer, reel-carrying devices and its own double pair of bull wheels. Conductors to 1,272,000 CM.

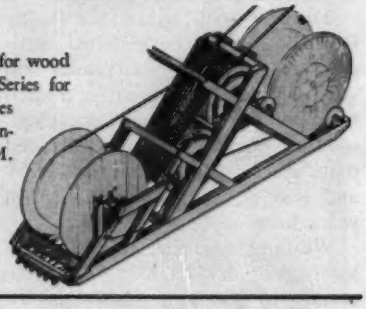
MODEL 7000-TR-I
Similar to model 6000-TR-I except larger. Conductors to 2 inches diameter.

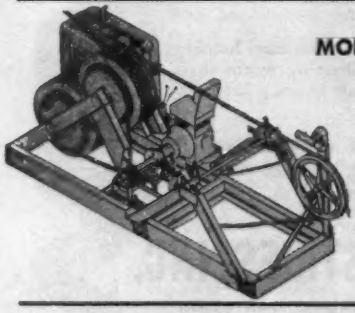




MODEL 5000-WS-TR
Similar to the 6000-WS-TR but smaller. Conductors to 556,300 CM.

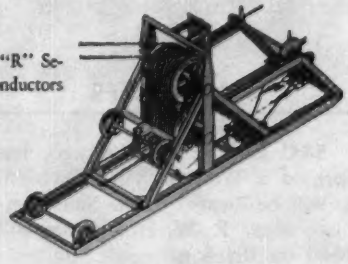
MODEL 6000-W
Available in "S" Series for wood or steel reels, in "R" Series for steel reels, or "SR" Series for trailer mounting. Conductors to 1,272,000 CM.

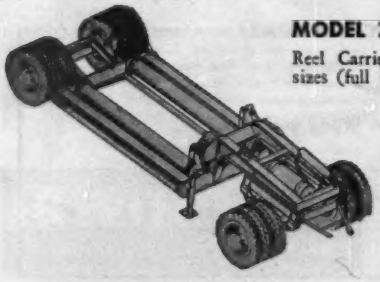




MODEL 6500
Bull Wheel Cable Puller. Available in "R" Series for steel reels, "S" Series for wood reels. Conductors to 1,272,000 CM. Also available in "LWR" Model for extra-large steel reels. Model 5500 similar (smaller).

MODEL 5000-SR
Available in "S" Series, "R" Series, or "SR" Series. Conductors to 556,300 CM.





MODEL 7500
Reel Carrier. Takes the largest sizes (full range) of steel reels. Loads and unloads with one man. No auxiliary equipment needed except the truck that pulls it. For use with any one of the tensioning machines shown on this page.

ADDITIONAL MODELS NOT SHOWN

Tension Reel Trailers

MODELS 2, 3, and 4, Two-Wheel Straddle Dollies not shown. For use with any one of the tensioning machines shown on these pages.

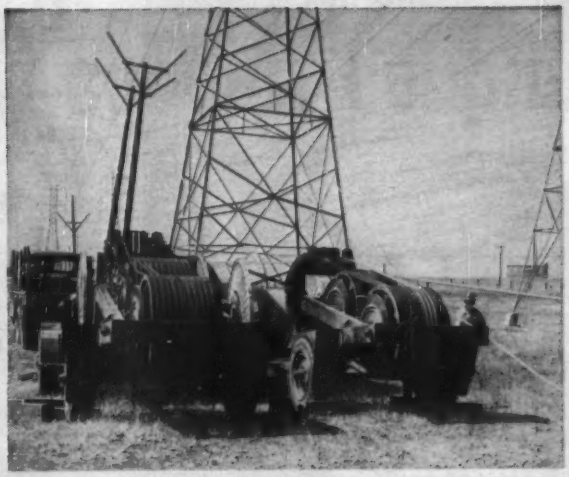
Tension Stringers

MODELS 6000-SK-I and 6000-SK-II For one or two conductors to 1,272,000 CM Skid mounted for installation on owner's equipment.

MODELS 5000-SK-I and 5000-SK-II Skid mounted for installing on owner's equipment. For stringing one or two conductors to 556,300 CM.

MODEL 5000-WS-III Strings three conductors to 556,300 CM. For mounting on low-bed or full trailer.

MODEL 6000-WS-III Strings three conductors to 1,272,000 CM. For mounting on low-bed or full trailer.



Two PENGO model 6000 TR-II wire tensioners being used by Pacific Gas and Electric Co. in reconductoring job between Vacaville, Calif. and Cottonwood, Calif. 285 miles of 500 MCM copper is being replaced by 954 MCM aluminum in this operation.

Newest method of stringing overhead lines

Two PENGO model 6500 Bullwheel Cable Pullers used by Pacific Gas and Electric Co. for pulling in the new line on the job mentioned above. Unit, manned by an operator and one reel tender, pulls the pulling line (in this instance the old copper conductor) over the double neoprene lined Bullwheels and winds it for shipment in a single operation.

- ***Safest, most economical way of stringing transmission, distribution and even secondary lines.***
- ***Its greatest savings are effected when stringing over and through energized circuits . . . by far the safest, too!***
- ***14 Patents pending.***

Smooth, positive control of conductor tension can be maintained at all times regardless of model or size of PENGO tensioning equipment used. The large, specially designed PENGO disc brakes are mounted away from the Bullwheels to assure dissipation of the heat generated by the continuous braking action and prevent transmission of the heat to the Bullwheels.

Note the wide range of models on the opposite page available for all types of jobs or terrain and for all sizes of conductor.

List your requirements and send for descriptive literature and prices.

Made by the makers of the World-Famous
PENGO EARTH AUGERS

PETERSEN
ENGINEERING COMPANY
Santa Clara, Calif.

PETERSEN ENGINEERING CO.
Santa Clara, California **Dept. 4**

Please send me more information on the new Pengo wire stringing equipment.

Name_____

Firm_____

Address_____

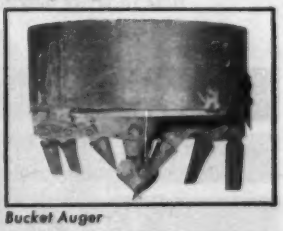
City_____ State_____

Other PENGO Products include:

24 inch Heavy Duty Flight Auger

Double-Helix Heavy Duty Auger

Offset Boring Head



Bucket Auger

Screw Bit for Small Diameter Holes

Pulling Eye

Pole and Transformer Chariot

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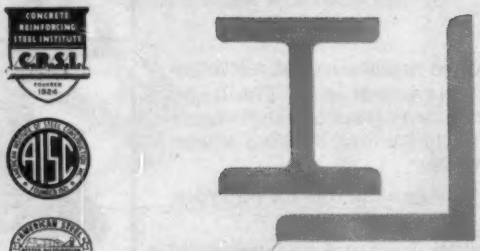
STEEL CORPORATION
TULSA - - - - - - - - MEMPHIS

This emblem on fabricated steel is assurance that it has been fabricated in compliance with industry codes. The facilities and personnel to fabricate products in strict accordance to customer's specifications.

FABRICATED REINFORCING STEEL
STEEL WAREHOUSE DISTRIBUTORS
FABRICATED STEEL PLATE
FABRICATED GALVANIZED STEEL
FABRICATED STRUCTURAL STEEL



for over 40 years

FLINT STEEL CORPORATION

TULSA . . . MEMPHIS

SALES ASSIGNMENTS

COMPANY STAFFS

Babcock & Wilcox Co's Boiler Division has announced the appointment of Claude L. Huey as Atlanta district manager to succeed Paul R. Yopp, who has retired.

Bakelite Co, plastics division of Union Carbide & Carbon Corp, has appointed the following department managers in its sales organization: J. L. Rodgers, molding and extrusion materials department; A. F. Sward, bonding materials department; and J. B. Knowles, consumer products department.

General Electric Co's Construction Materials Division has appointed Peter L. Kenney and Henry A. Zarozny as district representatives to handle the conduit products line and the wire and cable products line, respectively. Both men, with offices in Bridgeport, will cover the Connecticut area . . . V. S. Cooper is new south central regional manager of GE's Supply Co Division's supplies and housewares department. Thomas K. Edenfield has been named general manager of the same department.

Minnesota Mining & Manufacturing Co has designated Edward A. Freiburger as Chicago branch sales manager of its Electrical Products Division.

Radio Corp of America's Service Co, Inc, has appointed the following managers for eight service regions of its technical products service department: B. D. Bachin, eastern region, with headquarters in New York; M. E. Wheaton, mideast region, Philadelphia; C. L. Swinney, southeast region, Atlanta; W. W. Gilreath, southwest region, Dallas; E. D. Van Duyne, west central region, Kansas City; F. W. Hamre, central region, Chicago; H. M. Madison, western region, Hollywood, Calif; and H. E. Frisbie, east central region, Cleveland.

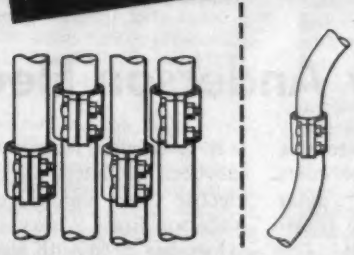
Westinghouse Electric Corp has appointed Joseph F. Kempf, Jr, as midwestern region sales manager of its Lamp Division with offices in Chicago. His territory comprises ten midwestern states . . . Lamp Division's Robert P. Shelly is new Philadelphia district sales manager . . . Recently appointed Detroit district gearing sales engineer was Walter J. Laita, who will be responsible for the Michigan and northwestern Ohio area, with headquarters in Detroit.

Western Electrical Instrument Corp, a subsidiary of Daystrom, Inc, has named Kenneth C. Moulton manager of its new Los Angeles branch office. Edward B. Annett, Jr, has been appointed district sales manager for the Cincinnati territory.

Willys Motors, Inc, has designated K. S. Moyer as central division manager, with offices in Chicago. He replaces C. W. Grinstead, who has been named director of advertising and merchandising.

"*TOUGH" conduit coupling jobs

(Type "SP")
Interior thread meshes with conduit threading for rigid, tight-fitting connection.
are easy with O. Z.
split couplings
Bolt heads are held in place by shoulder on coupling, eliminating need for second tool.
One piece malleable iron construction facilitates handling during installation.
To install, simply slip over one conduit end, butt ends of both conduits, slide fitting back into position and tighten nuts.



* **"Tough"**—(Where ordinary couplings can't be installed). Are clearances close—near floor, wall, ceiling or other obstructions? Can conduits be turned due to bends? Is space or accessibility a factor? Just install an O. Z. Type "SP" Split Coupling.

Butt the conduit ends within the O. Z. Split Coupling —tighten two nuts with an ordinary open-end wrench and presto . . . you have a permanent, close-fitting, rigid connection.

Drastically reduced installation costs, plus initial savings of as much as 50% in larger sizes, over similar competitive fittings, are just two of the many reasons why you should specify O. Z. Split Couplings for your difficult conduit coupling jobs.

Call your local O. Z. distributor . . . he is ready to make immediate delivery from stock on sizes from ½" to 5".

O.Z. ELECTRICAL MANUFACTURING CO., INC.
262 BOND STREET • BROOKLYN 17, N. Y.

CAST IRON BOXES
CABLE TERMINATORS
POWER CONNECTORS
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CONDUIT FITTINGS

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Office and Factory: 749 Bryant Street, San Francisco 7, Calif. • GArfield 1-7846

Columbus & Southern Ohio Names H. V. Potts as V P

Columbus and Southern Ohio Electric Co has elected H. V. Potts as its vice president in charge of employee relations. The new post being assumed by Potts was announced by Harry M. Miller, president of the company, at a recent meeting of the board of directors.

The new vice president came to the company more than 30 years ago shortly after graduating from the Columbus Business College.

Potts was first employed with the Columbus Railway, Power & Light Co, a predecessor of the present utility, in 1925. He served in various supervisory capacities in the company's transportation department before being appointed to the post of director of employee relations seven years ago.

H. V. POTTS

Storck Is New Chief Engineer

Norman C. Storck began the new year by assuming the duties of chief electrical engineer for the Wisconsin Electric Power Co.

In his new capacity, Storck becomes head of the company's electrical distribution department replacing William E. Gundlach who retired January 1 after more than 46 years of service.

Storck came to Wisconsin Electric Power Co in 1937 as a junior engineer soon after graduation from the University of Wisconsin. After progressing through various engineering positions, he became an assistant to the superintendent of electrical operation in 1952 and, in August 1956, was named assistant chief electrical engineer.

At present, Storck is chairman of the Milwaukee section of the American Institute of Electrical Engineering.

NORMAN C. STORCK

Three Executives Upped By Anderson Electric

Anderson Electric Corp has announced the election of Robert E. Schuler as chairman of the board and chief executive officer.

He is succeeded as president by Thomas H. Fox, formerly executive vice president, who also becomes treasurer and general manager. John H. Schuler was elected vice president and secretary.

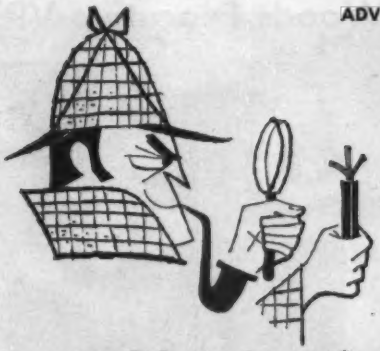
ROBERT E. SCHULER THOMAS H. FOX JOHN H. SCHULER

R. E. Schuler, formerly president, has been affiliated with Anderson Electric Corp and its predecessor, Anderson Brass Works, since 1925.

Fox has been with the company since 1944 as executive vice president and purchasing agent. A graduate of Georgetown University, he had previously served with the First National Bank of Birmingham in the legal department.

J. H. Schuler joined Anderson Electric in 1950 after graduating from Alabama Polytechnic Institute. Before taking over his present post he served as assistant to the executive vice president and as assistant secretary of the firm.

ADVERTISEMENT



CURRENT TRENDS

No. 7 in a series of articles

Cable Identification?

Nearly all electrical cables must carry identification for such various reasons as to establish identity of manufacturer, age, circuit choice and temperature rating. Of these, the important identity to most users is to readily permit proper circuit or phase selection as well as source of manufacture. The methods employed to gain these objectives must result in quick and clear intelligible information conveyed in a medium which is reasonably permanent and economical to achieve.

Circuit Identification

The subject of circuit identification in cables is somewhat complex. Its purpose is obvious—to identify a particular circuit, phase, polarity or other end use towards easier installation and maintenance. The most conservative approach eliminates all requirements for circuit identity within the cable so that each and every circuit must be electrically "rung out" or checked by the installer. However, the most popular approach requires some particular form of identity, of which there are many. Industry standards for a particular type of circuit identity have been established by many groups including IPCEA, NEMA, NEC, ASA, IMSA, Underwriters' Laboratories, and many others.

Insofar as control cable is concerned the original NEMA color sequence arrangement has become so well established that any newer methods simply represent an alternate interpretation of the original system as outlined in IPCEA Table XXX. This provides for 127 different color combinations by the employment of solid base colors and either one or two stripes or tracers of a contrasting color. This procedure as originally established was intended for fabric braid coverings where it was a simple matter to insert colored tracer threads in one or more carriers of the woven braid. To apply the identical procedure to modern jacket coverings over the insulated conductors such as Neoprene and polyvinyl chloride where braids are not employed presents certain problems. Hence, the development of a new identification method (IPCEA Method 3) now used by the Rome Cable Corporation for these types of multiconductor control cables where a contrasting, permanent surface printing is applied over a single black or neutral base color. The first six primary colors are printed 1-black, 2-white, 3-red, 4-green, 5-orange, 6-blue. For more than six conductors the tracer color is printed directly following the base color such as 7-white-black, 8-red-black, etc. To be readily distinguishable the printing appears on opposite sides of each conductor at regular frequent intervals. This low-cost method is strongly recommended for these types of cables since it expedites production, eliminates problems of color matching and fading, eliminates errors due to color blindness which is fairly prevalent, and provides a positive method of identification for the life of the cable. Other identification possibilities involving colored spirally or longitudinally applied stripes over colored jackets are also used and are described in IPCEA Methods 1 and 2.

Power cable identification is simplified since here we are only concerned with a maximum of three or possibly four phase identities which may be accomplished in a number of ways. On unshielded non-metallic sheathed cables a preferred system utilizes permanently molded longitudinal ribs on the sheath surface. The same procedure may well be used on shielded cables although appropriately printed semiconducting tapes under the metallic shielding tape has been generally accepted. On lead sheathed cables a colored tape directly under the lead sheath accomplishes the job. On certain multiconductor signal, telephone, telemetering, instrumentation and communication cables a simple method of circuit identification is frequently employed which consists of one colored conductor or pair in each layer of the multi-layer assembly of conductors. This colored circuit serves as a reference point from which the remaining circuits may be located by counting in a given direction in each layer.

Manufacturer and Miscellaneous Identification

A relatively simple time-proven system is used by most cable manufacturers to identify their product as an aid in reordering or replacing cable. Manufacturers of Underwriters' labeled products such as building wires and cords are assigned specific colored marker threads to be incorporated in their products and most manufacturers usually extend the use of these same colored threads in other cable products where practicable. This identification consists of colored combinations of small threads. For example, Rome Cable Corporation uses one yellow and one blue thread. These threads may be incorporated in appropriate locations within the cable design, such as in or over the stranded conductor, in the interstices of a multi-conductor assembly or under the outer sheath. Other methods of manufacturer identity are frequently used such as stamping on solid conductors, printed marker tapes, or surface printing in some acceptable manner such as the permanently molded name used on all Rome-60 portable cables. In some cases even the customer name and other information may be included where practicable and added cost is not prohibitive.

A printed marker tape incorporated within the cable assembly is the easiest approach to this situation which may be further embellished with unit length markings as well as date of manufacture. A rather novel method to accomplish this was developed by Rome Cable engineers (U.S. Patent 2,705,-735) which comprises recording on a magnetizable wire a record of information relating to the cable and combining this wire in a suitable location within the cable construction.

The foregoing represents only a condensed review of the highlights on this little publicized subject. Most problems, of which there are many, can be solved by following appropriate standards and some of the ideas mentioned above. Here again, Rome Cable's experience might be of real value to you, so why not discuss your particular cable identification problem with us?

ROME CABLE CORPORATION, Rome, New York

107

Philco Elects Gillies, Hardy, and Woods Executive VP's

James M. Skinner, Jr, president of the Philco Corp, recently announced the promotion of three vice presidents to the newly created post of executive vice president. Joseph H. Gillies will be in charge of operations; Larry F. Hardy, consumers products; and Dr Leslie J. Woods, research and engineering.

Gillies joined Philco in 1929 and was made vice president in charge of radio production in 1942 and vice president of manufacturing last year. He has been a director of the company since 1947.

Hardy, who has served with Philco since 1932, represented the firm in Chicago and the Northwest Division for many years. Elected a director in 1946, he became vice president in charge of product development in 1954.

Woods was stationed in Washington during World War II to help direct Philco's war effort. He was named vice president and director of the company's research and engineering in 1949.

JOSEPH H. GILLIES LARRY F. HARDY DR LESLIE J. WOODS

THOMAS K. McCARTHY

McCarthy Designated VP and Counsel

Kaiser Aluminum & Chemical Corp vice president and general manager, D. A. Rhoades, announced recently that Thomas K. McCarthy has been designated vice president and counsel.

McCarthy, prior to accepting his new post, had been closely associated with various Kaiser companies since 1941 when he became a member of the law firm of Thelen, Marrin, Johnson & Bridges. During recent years, however, he has given all his attention to Kaiser Aluminum & Chemical Corp.

The new vice president studied at the University of California where he received his bachelor of arts degree. He earned his LL.B in 1934 from the same school.

McCarthy is a member of the State Bar of California.

Dr B. D. Thomas Appointed Director at Battelle Institute

Dr B. D. Thomas has been named director of the Battelle Memorial Institute in Columbus, Ohio. In this position, he succeeds Dr Clyde Williams in the management of Battelle's extensive research operations in the United States and Europe.

A member of the Institute's technical staff since 1934, Thomas was named assistant director in 1942. Before that he was made secretary of the Battelle Memorial Institute Corp and in July, 1955, he became vice president.

Besides his scientific and technical activities, the new director has carried important administrative responsibilities for most of his 22 years at Battelle. He established and headed Battelle's first Division of Chemical Research in 1939.

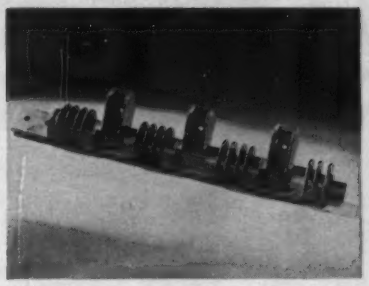
Dr Thomas is a graduate of the University of Washington where he was awarded a Du Pont Fellowship in chemistry.

DR B. D. THOMAS

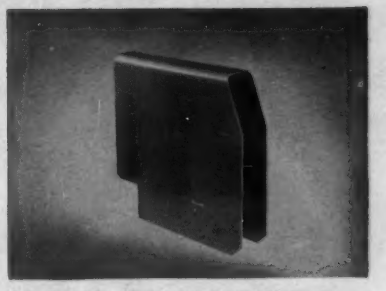
(Personal Briefs start on page 214)

C-D-F HANDLES THE COMPLETE JOB An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!

C-D-F KNOWS HOW TO MACHINE PLASTICS. A bus bar gets a covering of molded Dilecto over copper supplied by the customer. The plastic ends are skillfully trimmed on a smooth saw.



C-D-F MOLDS MANY SPECIALTIES. This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing.

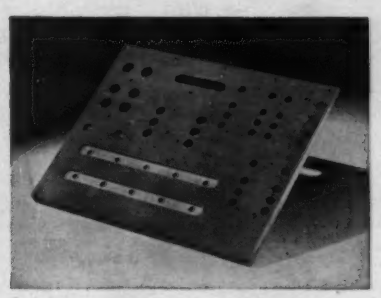


C-D-F USES MODERN METHODS. Large quantities of arc chute barriers are made from paper-based Dilecto. Operations include pressing, cutting, post-forming and trimming.

Dependable equipment relies on C-D-F insulation!

C-D-F OFFERS UNIQUE MATERIALS. This contact shaft for an air circuit breaker is another example of molded C-D-F Celoron used in switchgear because of its high impact strength.

C-D-F IS A SKILLFUL ASSEMBLER. Made from Grade C rolled Dilecto tubing, these pots are turned, bored, slotted. Then a macerated plastic end is inserted and arc resistant varnish finish applied.



C-D-F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS. Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space.

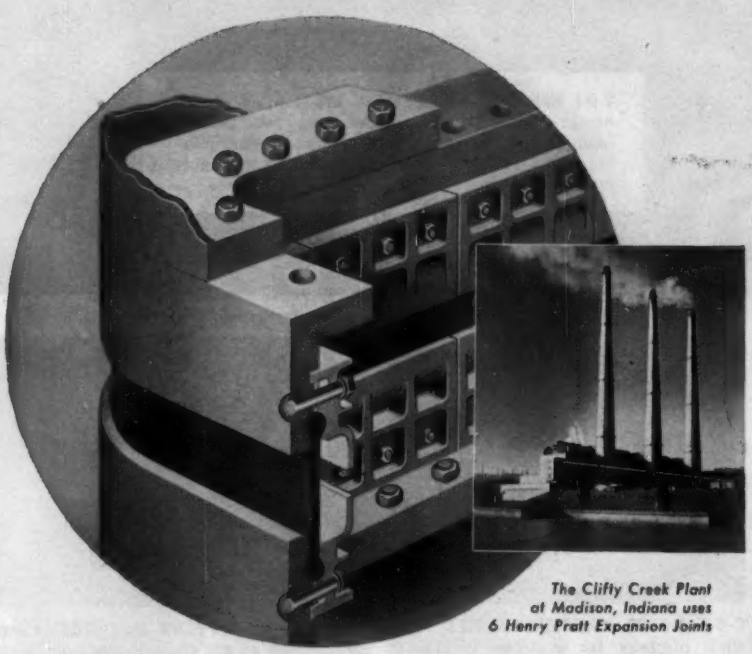
See our catalog in Sweet's Design File for basic product data and sales offices. Write for detailed information, or send us your print for quotation.

CONTINENTAL DIAMOND FIBRE

CONTINENTAL-DIAMOND FIBRE DIVISION OF THE BUDD COMPANY, INC.

NEWARK 15, DELAWARE

Pratt takes the pressure off a hot problem!



The Clifty Creek Plant at Madison, Indiana uses 6 Henry Pratt Expansion Joints

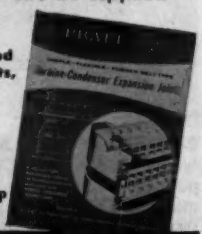
This expansion joint insures Turbine-Condenser alignment

The size and complexity of modern power plants have made it very difficult to foresee all the problems involved in mounting condensers and turbines. Often the final piping engineering is not completed until after the units are installed. By using a rubber belt expansion joint between the turbine and condenser, both the engineering and the construction are greatly simplified. Construction tolerance can be held to reasonably obtainable values because the expansion joint will absorb up to one inch of axial and one-half inch of lateral movement.

Any shape or size . . . Round or rectangular shapes can be built without size limitation . . . if one dimension is less than 14'9" the joint can be shipped fully assembled, a great convenience to installation. Connections for welding, bolting or combinations such as landing bar and weld can be supplied as needed.

The Henry Pratt Company offers complete engineering and manufacturing facilities for exhaust stacks and joints, flues, ducts, butterfly valves and other power plant equipment.

Write for this detailed folder, discusses Turbine-Condenser connection methods as well as detailing the Henry Pratt Expansion Joint
Ask for Bulletin–B-2P



HENRY PRATT

TURBINE-CONDENSER
Expansion Joints

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill.

PERSONAL BRIEFS

Ernest H. Nelson has been named manager of the Middletown Division and **Robert K. Vibert** manager, Farmington Division, of Connecticut Power Co.

As part of the planned integration of Jersey Central Power & Light Co and New Jersey Power & Light Co, the following divisional reorganization has been announced: Northern (formerly NJP&L's Eastern Div.), continues to be headed by **Jack H. Miller;** Western continues to have **Walter E. Gess** as manager; Central (formerly) JCP&L's Northern Div.) continues under management of **James V. Carver;** Bay (re-established by JCP&L) will be headed by **Jack R. McGalliard;** Coast Division will be headed by **Robert H. Sims;** and Southern Division (formerly JCP&L's Central Div.) will be managed by **T. Roland Height.** In other changes **William E. Liepe** becomes manager of rates and research for both utilities, and **Leonard Sloan** is new executive assistant to the president.

J. Donald Hogg has been named to succeed **Raymond P. Snow** as manager of Cleveland Electric Illuminating Co's purchasing department.

New chief electrician at Oklahoma Gas & Electric Co's Shawnee Division is **Warren St. George,** who replaces the late **James C. Bassett** . . . Duke Power Co has designated **Herman E. Shoaf** as electrical superintendent of the Winston-Salem district. He replaces **Joseph C. Mason,** new district manager.

Consumers Power Co has appointed **Ralph L. Albro** as Owosso district manager to replace **Sidney C. Dowling,** retired . . . **Delano J. Fitzgerald** has been named purchasing agent as well as chairman of Baltimore Gas & Electric Co's materials and supplies committee. New assistant purchasing agent is **Charles H. Gundersdorff, Jr.**

Louis Moss has been appointed purchasing agent of New Orleans Public Service Co, Inc, to fill the vacancy caused by the death of **James J. Morse.**

(More Personal Briefs on page 225)

New HOMELITE Pump

Whispers While It Works

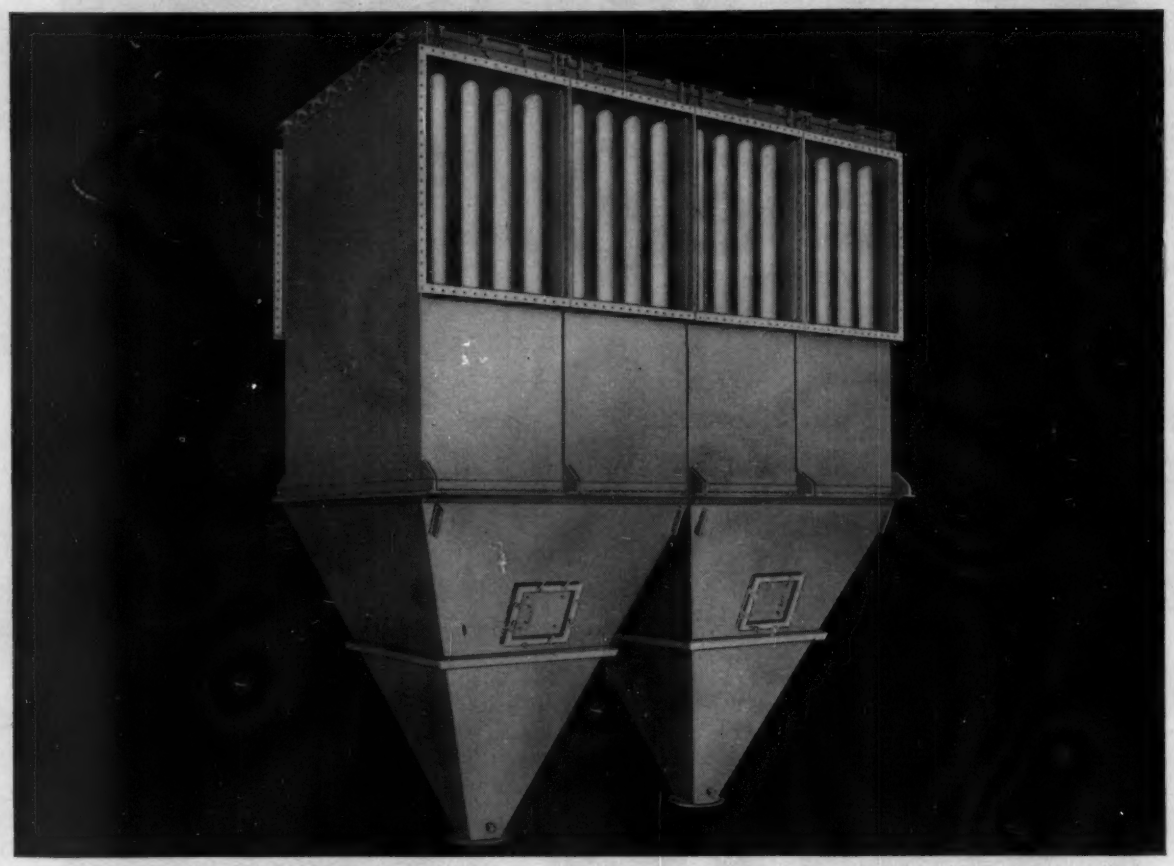
Goodby residential complaints! Here's a new lightweight gasoline engine driven pump that takes it easy on the neighbors' ears. Yet handles any water problem . . . from seepage to volumn pumping! The new Homelite Model 36 S2 2″ self priming centrifugal Pump operates at slow speed with low noise level yet has high capacity of 9000 gallons per hour. It weighs only 85 pounds and can be easily carried by one man to the best pumping location. Starts quickly, primes automatically, gives long, dependable and trouble-free service under the toughest conditions. Ask your Homelite Representative for a free demonstration. You'll find a good neighbor policy in every pump.

HOMELITE

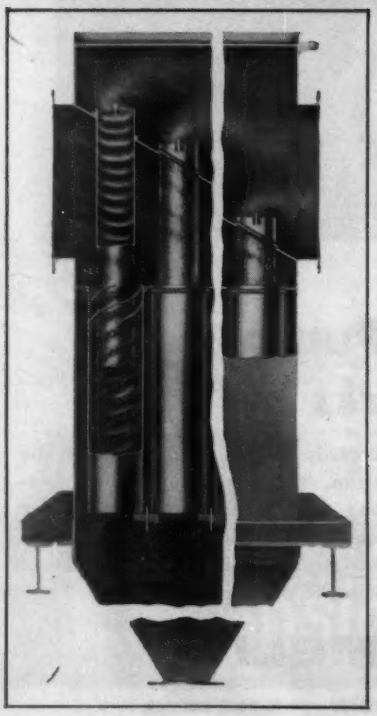
A DIVISION OF TEXTRON INCORPORATED

6101 RIVERDALE AVENUE • PORT CHESTER, N. Y.

Control fly ash with job-fitted



Series 342 Precipitator



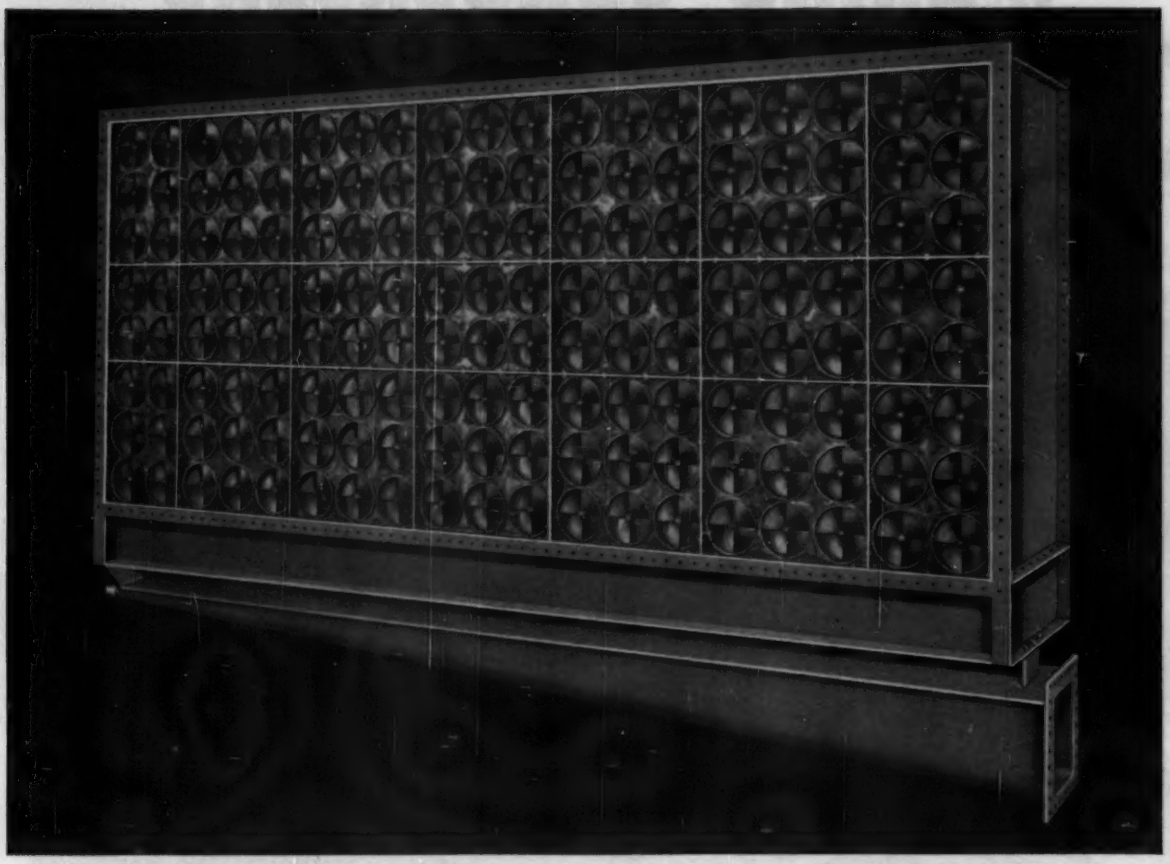
COMPACT DUST COLLECTOR – Series 342 Precipitator meets industry's need for a simple, compact, economical, all-purpose, mechanical-type dust collector. With the growing value of fly ash as a salable by-product, adequate, efficient collection is becoming increasingly important.

Easy to install because of its sectionalized construction, the Series 342 Precipitator has proved effective in controlling dust discharge to the atmosphere in a large percentage of industrial plants. The reason: since each tube assembly is basically an individual cyclone or centrifugal dust collector, the multi-tube Series 342 will deliver an over-all performance comparable to the high efficiency obtained by a single, small-diameter cyclone.

Furthermore, American Blower Series 342 Precipitator features welded-steel construction and removable tubes, is available in a variety of sizes to meet specific job requirements on either new or existing installations.

Dust-laden air or gas enters inlet plenum; gravity and centrifugal action force dust downward, adjacent to tube wall; dust is skimmed into gas-tight receptacle; cleaned air or gas moves upward through outlet tubes to outlet plenum.

American Blower precipitators

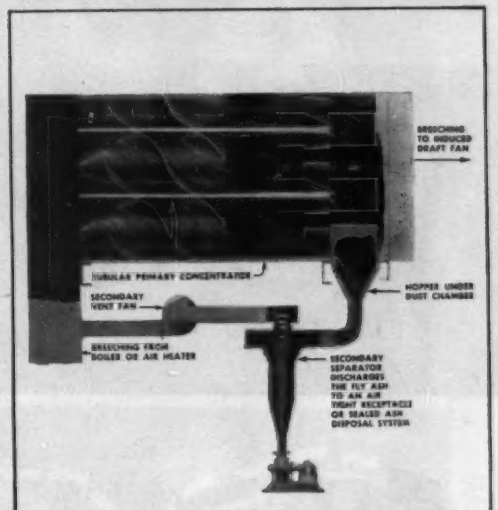


Series 361 Fly Ash Precipitator

FOR LARGE PUBLIC UTILITIES – Series 361 Fly Ash Precipitator offers maximum collection efficiency over entire operating range, occupies minimum space, and gives reliable performance, trouble-free operation.

What's more, the secondary separating system of the Series 361 makes it relatively more efficient at reduced loads when fly ash is finer and more difficult to remove. Then, too, ability to vary number and arrangement of individual cells makes it easy to tailor unit to the particular job.

Whatever your dust-collection problem, it will pay you to talk to an American Blower engineer. His knowledge of the application of precipitators and dust collectors can prove invaluable to you. Call your nearest branch, or write: American Blower Corporation, Detroit 32, Michigan. In Canada: Canadian Sirocco products.


BREECHING TO INDUCED DRAFT FAN
TUBULAR PRIMARY CONCENTRATOR
HOPPER UNDER DUST CHAMBER
SECONDARY VENT FAN
BREECHING FROM BOILER OR AIR HEATER
SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

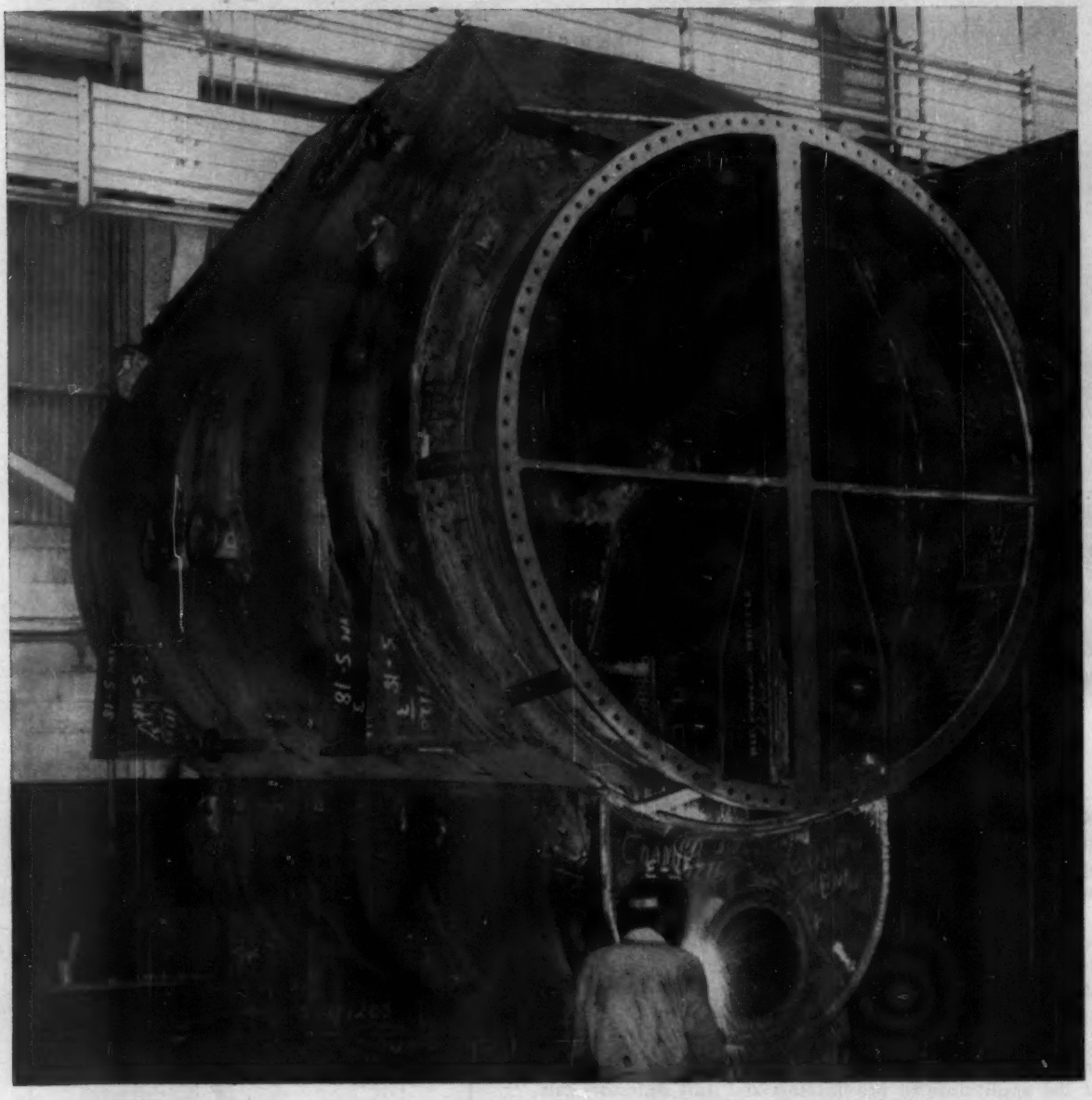
Secondary system results in velocity-efficiency characteristics which automatically maintain maximum efficiency over entire boiler load or operating range. Properly installed and operated, unit's collection efficiency is from 85% to 90%.

AMERICAN BLOWER

Division of AMERICAN-Standard

MARIND CONDENSERS

ECONOMY • RELIABILITY • PERFORMANCE



Thoroughly experienced design engineering and manufacturing staff. Every Marind job is backed by this Company's international reputation for outstanding quality, service, performance.

MARIND

POWER • INDUSTRIAL EQUIPMENT

Industrial Products Division

MARYLAND SHIPBUILDING & DRYDOCK COMPANY

BALTIMORE 3, MARYLAND • *Representatives in Principal Cities*

ELECTRICAL BUSINESS OUTLOOK

Electrical World
JANUARY 28, 1957

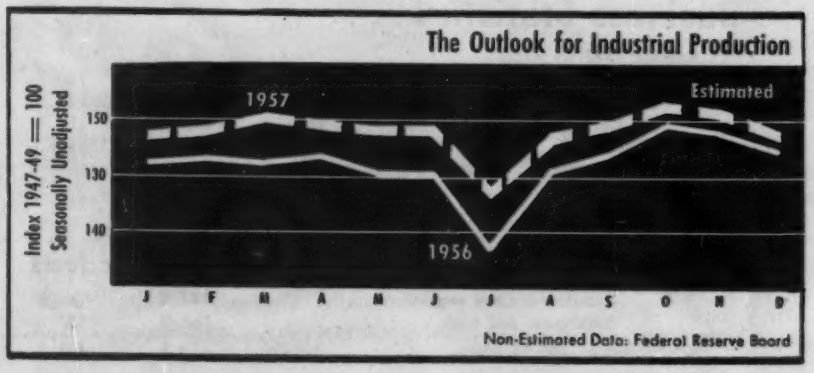
Federal Reserve Board seems to be shifting its credit policy into neutral. Don't expect a sudden let-up in the tension applied to the money market. But interest rates are not likely to go up much more. Observers believe the Fed is sufficiently convinced of the soundness of business needs to call off any further tightening. This policy will probably show up by the April 15 tax date. At that time the Fed will provide money for bank loans to ease business over heavy seasonal requirements. But it still does not appear that the Government will take special action to help any particular credit-hungry sector of the economy—housing for instance.

The Fed's attitude is part of a fairly general easing of inflation fears in Washington. A glance at the industrial price indexes bears this out. Wholesale prices of industrial commodities rose 4% in 1956. A big part of the push was concentrated in the late summer and early fall months. Since then the rise has tapered off. Prices of some basic commodities, including non-ferrous metals, have been dropping. The indexes strongly suggest that the dangerous pressures have been released.

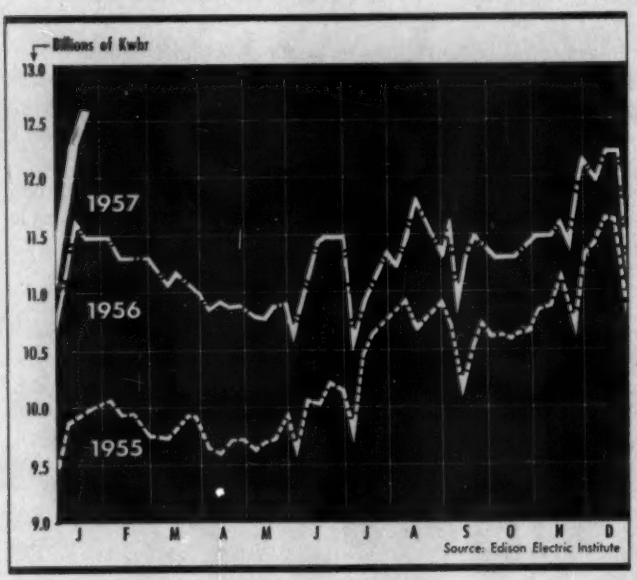
Government spending will likely rise even more than Ike's budget indicates. This holds particularly true for Defense Department spending. It's not easy to draw up close estimates when technology is moving along so fast that the experts don't know what designs they want or what materials they want in the designs. Technological advance is simply no respecter of even such a formidable thing as a budget deadline. Chances are that estimates will be scaled up rather than down. The credit and budget pictures together suggest that over-all Government action will be on the plus side for business in '57.

A 67% jump in average residential usage by 1960: This is the prediction of General Electric Co's W. V. O'Brien. "We have every hope," he said, that average yearly consumption will leap to 5,000 kwhr vs today's figure of about 2,995. O'Brien, VP and general manager of apparatus sales, cited these reasons: Industry-wide programs like Live Better . . . Electrically and projected consumption gains on farms, in industry, and in communities.

In '56 annual home use was 8.3% above 1955's 2,751-kwhr consumption, according to Electrical World's special report (see page 134). Last year's average residential electric bill was $77.18. This is 6.3% above the $72.63 tab in '55. Cost per kilowatt-hour dropped from 2.64¢ two years ago to 2.59¢ in 1956, a decrease of 1.9%.



STATISTICS



OUTPUT

Week ended Jan. 19, 12,556,000,000 Kwhr Up 9.0%

Per Cent Change From Previous Year

	Jan. 5	Jan. 12	Jan. 19
Total U. S.	+5.6	+ 6.3	+ 9.0
New Eng.	+3.9	+ 4.6	+ 9.9
Mid Atlantic	+2.7	+ 3.3	+ 7.6
Cent. Ind.	+4.8	+ 6.3	+ 8.4
West Cent.	+7.3	+10.3	+10.6
Southeast	+5.0	+ 2.9	+ 8.2
South Cent.	+9.6	+12.1	+11.9
Rocky Mount.	+9.4	+11.0	+ 9.3
Pacific			
NW	+6.4	+ 9.9	+14.6
SW	+9.9	+11.2	+ 7.0

Seasonally Adjusted Index 230.2
Week Ago 225.8
Year Ago 211.7

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 9.7%

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Oct.	119.38	118.66	112.13	6.5
Peak—Class 1 Systems. million kw	Oct.	96.6	96.5	90.7	6.5
Estimated Dec. '56 Peak	Oct.	106.20	106.17	104.34	1.8
Production—billion kwhr	Oct.	51.13	48.82	47.70	7.9
Hydro		9.24	8.96	8.80	4.9
Fuel		41.89	39.86	38.60	8.5
Sales—billion kwhr	Oct.	45.98	46.07	43.06	6.8
Residential		11.27	11.68	10.38	8.6
Commercial		7.37	7.82	6.88	7.1
Industrial		24.79	23.86	23.34	6.2
Other		2.56	2.72	2.45	4.5
Fuel Consumption	Oct.				
Coal—million tons		13.52	12.45	12.65	6.9
Oil—million barrels		6.27	5.20	6.04	3.8
Gas—million cu ft		114.36	124.63	104.80	9.1
Net Income Class A & B Co's—$ million	Oct.	95.79	108.45	94.61	1.2
Residential Customers—millions	12 mos.	45.49	45.39	44.21	2.9
Revenue per kwhr	ended	2.60¢	2.61¢	2.65¢	−1.9
Avg kwhr per customer	Oct. 31	2,942	2,929	2,715	8.4
Avg annual bill		$76.49	$76.45	$71.95	6.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Nov.	149	150	144	3.5
ENR Construction Cost	Jan..	148.4	147.6	141.8	4.7
BLS Cost-of-living	Nov.	117.8	117.7	115.0	2.4
New Orders for Machinery (1950 = 100)	Nov.	140	139	143	−2.1
NEMA Sales					
Insulation materials	Nov.	149	163	155	−3.9
Electric appliances		81	94	88	−8.0
Wholesale prices	Oct.				
Motors and generators		136.9	136.2	125.3	9.3
Transformers and regulators		144.8	144.8	129.2	12.1
Switchgear and fuses		161.9	157.0	146.3	10.7
GNP—annual rate—$ billion	3rd Qtr.	413.8	408.3	396.8	4.3

MANAGEMENT BULLETIN

FINANCE

Electric utility industry had another big schedule last week when over $56 million of new securities were offered to the public. Leading the way was the $10 million first mtge 4⅝% bond issue (A) of Southwestern Gas & Electric Co due in 1987 which was won by Merrill Lynch, Pierce, Fenner & Beane and Eastman Dillon, Union Securities Co group with a bid of 100.119%. Bonds were reoffered at 101% to yield 4.56%. Issue is "moving along" with 50% of it sold the first day . . . Halsey, Stuart & Co group won $35 million first mtge 4½% bonds (Aa) of Pacific Gas & Electric Co due in 1987 at 99.2159%; reoffered at 100% to yield 4.50%. Issue has been "all spoken for." . . . As EW was going to press, Dean Witter & Co and Western Light & Telephone Co were setting a price on an offering to WL&T commonholders of 65,787 shares of $25 par conv. preferred stock, record Jan. 22 to expire Feb. 6 (For latest financing see p 19).

The $20 million first mtge 4½% bonds (Aa) of Oklahoma Gas & Electric Co which were won by Halsey, Stuart & Co group on a bid of 100.22% and reoffered at 101.155% to yield 4.43% were sold and the books closed.

Southern Co ups quarterly common dividend to 27½¢ a share vs 25¢ previously. Earnings per share for the system amounted to $1.53 in 1956 as compared with $1.34 in 1955. System expects to spend $138.9 million for construction in 1956.

New security issues planned . . . New England Power Co to sell competitively $10 million first mtge bond due 1987; Quebec Hydro-Electric Commission, $35 million debentures due 1977; Dayton Power & Light Co to offer shareholders 328,630 common shares on 1-for-8 basis with an oversubscription privilege.

Pacific Gas & Electric Co has received PUC approval to acquire Pinole Light & Power Co, issuing 7,000 shares of PGE stock in return for 200 shares of Pinole securities.

Black Hills Power & Light Co asks Wyoming PSC approval for accounting procedures relative to use of accelerated depreciation on 1956 tax returns.

REGULATION

These bills have been introduced in the New York State legislature. Amend Public Service Law to provide that cost to public service commission of testing electric and gas meters shall be paid by applicant and to allow applicant to be heard as to amount of cost and amend law to provide that rates and charges for telephone and telegraph, common carriers, railroads, and street railroad corporations shall be based on reasonable return on capital actually expended instead of value of property actually used in public service.

Tallahassee City Commission boosts electric rates 3% in wake of rising fuel oil prices. New rate will go into effect with Feb. 28 billing.

Idaho's Gov Smylie urges legislature to provide funds necessary for the State Public Utilities Commission to retain qualified rate experts.

Vermont Legislature studies bill which would permit that body to select members of the state PSC. Commission members at present are appointed by the Governor.

LABOR

Nuclear engineers to direct reactor experiments and supporting research and development are being sought by Atomic Energy Commission at salaries ranging from $5,000 to $12,000 a year. Engineering or science degrees required.

Public Service Co of Colorado offers all employees Salk polio vaccine shots free of charge.

Key employee stock purchase plan for Cleveland Electric Illuminating Co has

been approved by the Ohio state utilities commission. The utility is granted permission to issue 200,000 shares of common stock with par value of $15 a share. The stock will be offered at less than market value to not more than 75 key employees a year. Plan is designed to attract and retain key employees.

PUBLIC RELATIONS

It's one-stop service for 90% of the customer calls coming into Union Electric's switchboard. These calls are switched to a centralized customer service group equipped to handle account, trouble, and other types of information requests or complaints promptly and efficiently. Surveys indicate the customers like this method of handling calls.

West Penn Power Co again this year will match the cash awards won by any community it serves in the annual Pennsylvania Community Development Contest sponsored by the State Chamber of Commerce. Thus winning communities in West Penn territory will receive double the regular awards which range from $100 to $1,500.

Closing date is May 9 for entries in the Reddy Kilowatt Annual Report Contest. For full contest rules and list of awards write Ash Collins, Reddy Kilowatt, Inc, 50 Church St, New York, 7, N. Y.

YOUR HEALTH

Mumps Can Be Serious

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co

Mumps in an adult is serious because of its high disabling rate.

Mumps has been regarded as a contagious childhood disease. It is now known to be a disease of all ages caused by a virus. The mumps virus first invades the respiratory tract, then enters the blood stream and localizes in glands or organs of the body.

Mumps is most prevalent in winter and early spring. By age 17, 90% of the population will have been infected by the virus, but only 60% will have had mumps. Many of those infected, but not having the disease, are carriers capable of spreading the disease.

Usually the diagnosis of mumps is self-evident. Some times it is a difficult diagnosis to make. There is a specific blood test for mumps as well as a skin test for susceptibility to the disease.

The incubation period of mumps is about 18 days after exposure. Its symptoms are tiredness, headache, loss of appetite, chills and fever, and pain and swelling of the parotid glands located in front of each ear. Usually one gland is involved, then 1 to 3 days later the other becomes painful and swollen. The skin over the glands is tense but not red, and pain is increased by movements of the jaw. Swelling reaches its maximum within 48 hours and persists for 7 to 10 days. The temperature is high for 2 to 4 days.

Frequently the mumps virus localizes in other places than the glands about the face. It may involve the central nervous system and resemble poliomyelitis, causing a stiff neck, drowsiness, nausea, vomiting and coma. The patient usually recovers from this complication within 2 weeks.

Frequently, and particularly in the adult, it may localize in the testicles. This complication, most commonly observed about 4 days after the onset of the illness, is accompanied by prostration, severe pain in the involved testicle and a high fever. Atrophy of the involved testicle follows in about 50% of the cases. Few cases have both testicles involved. The ovaries in the female are seldom involved. A temporary inflammation of the pancreas also can occur.

A simple case of mumps is treated with bed rest, ample fluid intake and aspirin. Either heat or cold may be applied to the involved parotid glands.

Patients with testicular involvment are kept in bed. The testes are supported and an ice bag is applied. Some physicians use Cortisone derivatives.

By having mumps you gain an immunity to the disease. A vaccine has been developed which will give immunity for a short time. At present routine immunization in children is not advisable. For adults immunizations during epidemics may be recommended.

Many persons have died or been crippled by the so-called childhood diseases. No matter what the disease may be, it should be treated with respect. Take care of your body and it will serve you well.

FIVE STEPS TO 493,000 KILOWATTS

Units 1 and 2 of Potomac River Station are each of 92,000 kilowatts capability. Units 3, 4 and 5 are of 103,000 kilowatts capability each.

- The initial installation of Potomac Electric Power Company's Potomac River Steam Station serving the District of Columbia and surrounding territory was completed in 1949.
- A second unit was installed in 1950.
- The third unit was installed in 1954.
- Unit #4 went on the line in 1956.
- And a fifth unit is scheduled for completion in 1957.
- Total capability of the five units will be 493,000 kilowatts.

The design and construction of the entire station was by Stone & Webster Engineering Corporation.

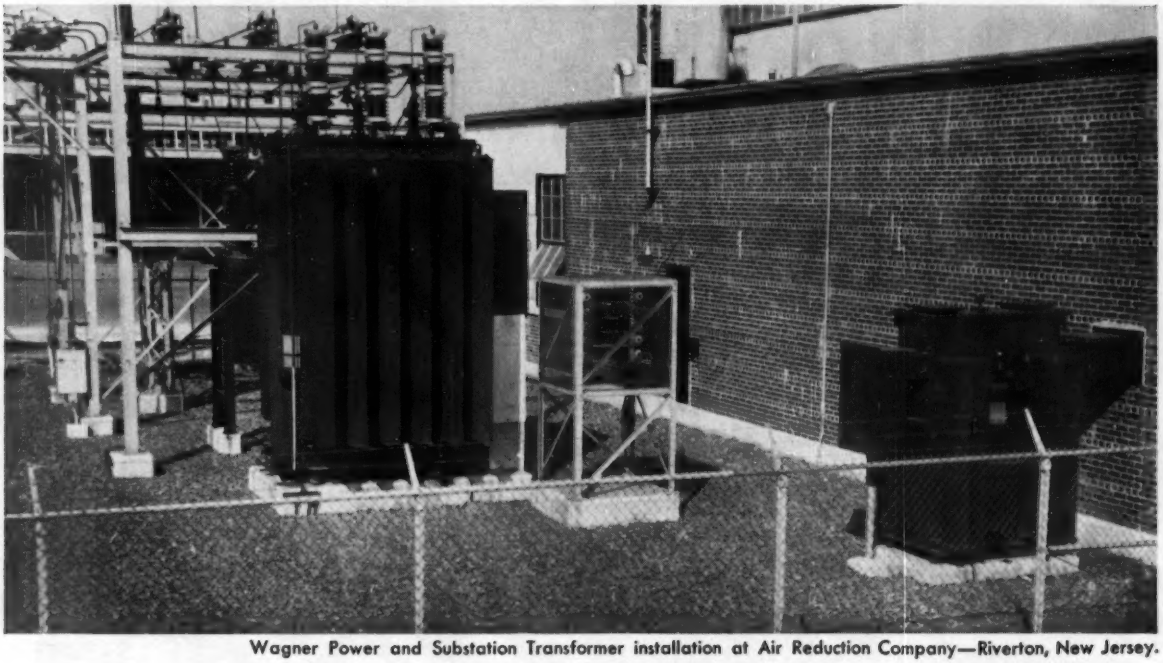
•

If you have a problem of design or construction, our broad experience in these and related fields may help you solve it. Write or call us for complete information on our services.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY of STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston Los Angeles San Francisco Seattle Toronto



Wagner Power and Substation Transformer installation at Air Reduction Company—Riverton, New Jersey.

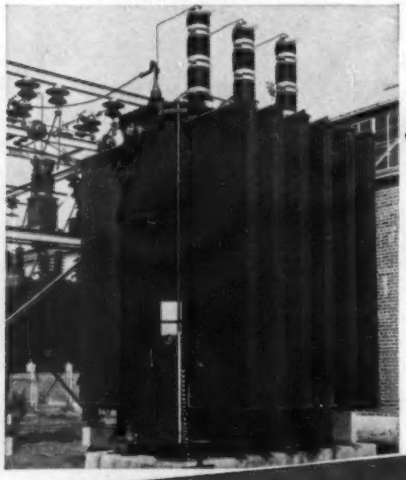
Taking raw materials from the air

The Air Reduction Sales Company manufactures liquid products direct from the atmosphere—products like oxygen, nitrogen, argon, and neon. In some cases, the liquids are then converted into gases for industrial and medical use.

Such scientific sleight-of-hand in transforming air into product is made possible on a mass-production basis only through the use of electricity . . . the source of power for all modern production.

Wherever electric power is used, Wagner Transformers efficiently and dependably handle their never-ending job of supplying proper voltages for every purpose. At Air Reduction's Riverton, New Jersey plant, this power is supplied through Wagner Transformers.

Let a skilled Wagner engineer discuss your transformer needs with you. Call the nearest of our 32 branch offices, or write us direct.



This 7500 kva Wagner Power Transformer supplies power for Air Reduction Company's Riverton, New Jersey plant.

The 1000 kva Wagner Substation Transformer steps down to 480 volts for motor circuits in the plant.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

WT57-A

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6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

PERSONAL BRIEFS (*Continued from page* 214)

John A. Patterson has been appointed manager of Appalachian Electric Power Co's Clinch River plant now under construction at Carbo, Va. He will be succeeded as Logan plant manager by **Paul T. Schneider.** Both appointments become effective Feb. 1.

Sierra Pacific Power Co's **H. P. Dayton** has resigned as vice president and director after 34 years with the utility.

Oscar J. Rotty has been placed in charge of Union Electric Co's newly established transmission and distribution development engineering component. **Richard G. Steiner** rises to standards engineer-transmission and distribution and succeeds **Robert T. Fisher** as head of standards and load analysis.

Charles M. Crowell has been named supervisor of the inventory control department of Dayton Power & Light Co.

Southern Services, Inc, has promoted **W. R. Brownlee** from system study engineer to system planning engineer to succeed **O. E. Charlton,** recently named electrical engineer . . . **Earl L. King** will become manager of Iowa Rural Electric Co-operative Association on Feb. 1.

Retirement of **Ed F. Pearson** as head of the Portland district operations for Pacific Power & Light Co and appointment **Roy Vernstrom** to assistant general manager with responsibility for the Northwest area, were announced by Pres Paul B. McKee recently.

Charles J. Wieboldt has been elected secretary of Commonwealth Services, Inc, to succeed **Edward E. Nelson** who has retired as secretary and director.

C. R. Machen has been appointed general superintendent of electrical transmission and distribution for Pacific Gas & Electric Co to replace **Thomas B. Copeland,** who has retired. Machen formerly served as assistant to Copeland and as electric superintendent in PG&E's East Bay Division.

Iowa Power & Light Co has named **John McLaughlin,** vice president, director, and manager of the engineering department, as general manager of sales, operations, and engineering. He assumes some of the responsibilities previously held by **Joseph Schilling,** who recently retired as executive vice president.

Duke Power Co has designated **James K. Hallman** as manager at Lincolnton to succeed **Lester C. F. Abernethy.**

Lawrence M. Edwards is new general engineer of Savannah Electric & Power Co. Others promoted were **Charles F. Baker,** to assistant general engineer; **Ewell M. Alexander** to supervisor of real estate and rights-of-way; and **Winfield C. Smith** to distribution engineer.

Public Service Co of Colorado has appointed **Wilbert G. Metzler,** a detective on the Denver police force, as chief security officer.

Newly elected president of Intermountain Electrical Association is **De Lamar Holt,** residential and farm director of Utah Power & Light Co's businesses development department. **Leo A. Hansen, Jr,** of Westinghouse Electric Corp, is vice president.

Oregon Public Utilities Commissioner **Charles H. Heltzel,** who served under three Republican governors as head of the state's regulatory agency, resigned.

T. A. Phillips, vice president of Arizona Public Service Co, had been named chairman of Arizona Council of Engineering and Scientific Associations, a newly organized statewide group composed of all fields of engineering.

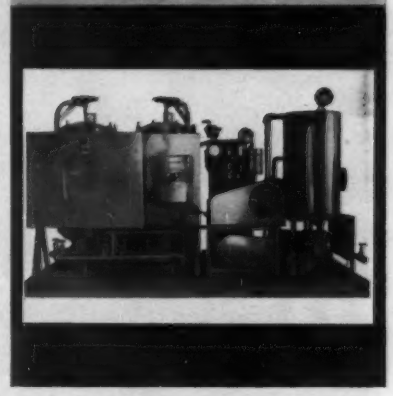
Utah Water & Power Board recently named **Jay R. Bingham** as director and executive secretary to succeed **Gov George D. Clyde . . . James E. Kesler** is new safety supervisor of Illinois Public Service Co.

Recently named chief construction engineer for Tennessee Valley Authority was **Henry T. Lofft.**

(More Personal Briefs on page 228)

• PURIFY
• DEHYDRATE
• DEGASIFY

insulating oil in one simple operation with CFC PURIVAC



The CFC Purivac (formerly Honan-Crane) indefinitely extends the life of insulating oil in transformers, circuit breakers, oil filled cables, etc. Purivac purifies, dehydrates and degasifies large volumes of insulating oil in one automatic operation. Both solid and soluble contaminants are removed. Dielectric strength of oil is restored.

Purivac operates in the field (while electrical equipment is in service) or at a central reclaiming station.

Eliminate costly transformer cleaning operations — reduce deterioration of fabric insulations — with Purivac.

Write for technical literature to Department EW.

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Ind.

New! Alcoa

RANGE OF CONDUCTOR FOR EACH GROOVE SIZE

Groove Size	Dia. Range Min.	Dia. Range Max.	ACSR Min.	ACSR Max.	Stranded Conductor Min.	Stranded Conductor Max.
1	.292	.502	2 (6/1)	3/0 (6/1)	2	3/0
2	.464	.743	3/0 (6/1)	397.5MCM (18/1)	3/0	400MCM
3	.743	1.060	397.5MCM (18/1)	715.5MCM (26/7)	450MCM	800MCM

(See captions under clamps)

Catalog 581.1
(top, groove #1)
(bottom, groove #1)

Catalog 582.1
(bottom, groove #2)
(top, groove #1)

heavy-duty, universal, parallel groove clamp

Six new Alcoa clamps handle connections on #2 to 715.5MCM conductors

These new heavy-duty U-bolt clamps reduce inventories to a new low. They cover the full range from #2 to 715.5MCM ACSR . . . also handle #2 to 800 stranded. The new development is based on a new universal groove design in the spacer.

These new clamps have had months of extensive laboratory testing. They have undergone 1000 heat cycles using various conductor combinations. Test current used produced conductor temperatures of 200° F. There was no significant change in connection resistance. They are proven clamps.

Generous dimensions mean added strength and reliability. All proportions—length of clamps, number of bolts, bolt sizes—are engineered for the range of conductor size accommodated and the job to be done. Alcoa® U-bolt clamps have given proven service for over 25 years. The experience gained during this quarter century has been applied in designing these new heavy-duty, universal, parallel groove clamps.

Both clamp and bolts are made of aluminum for equalized expansion and improved clamping pressure. U-bolts provide wrap-around strength and are flattened to reduce bulk and distribute pressure. Bolts and nuts are hard-surfaced with an Alumilite® finish and dipped in No-Ox-Id. This hard finish and lubrication reduce thread friction, provides greater clamping force and corrosion resistance.

Your Alcoa representative has samples of these clamps and full details. Let him show you how they can reduce your inventory, help on your connecting problems. Or write Aluminum Company of America, 2306-A Alcoa Bldg., Pittsburgh 19, Pa.

THE ALCOA HOUR—
Television's Finest Live Drama—Alternate Sunday Evenings

ALCOA ALUMINUM
CONDUCTORS & ACCESSORIES
ALUMINUM COMPANY OF AMERICA

Your Guide to the Best in Aluminum Value

Catalog 582.2
(top, groove #2)
(bottom, groove #2)

Catalog 583.1
(bottom, groove #3)
(top, groove #1)

Catalog 583.2
(bottom, groove #3)
(top, groove #2)

Catalog 583.3
(top, groove #3)
(bottom, groove #3)

Functional catalog numbers: digit to left of decimal is number of bottom groove, digit to right is top groove.

NOW DO MORE WORK WITH ANY LINE TRUCK

GREATEST OPERATING RANGE OF ANY PINLESS DERRICK

SINGLE CYLINDER—PISTON ROD TOTALLY ENCLOSED

POSITIVE LOAD CONTROL IN ALL POSITIONS

NO CENTER LEG IN FLOOR

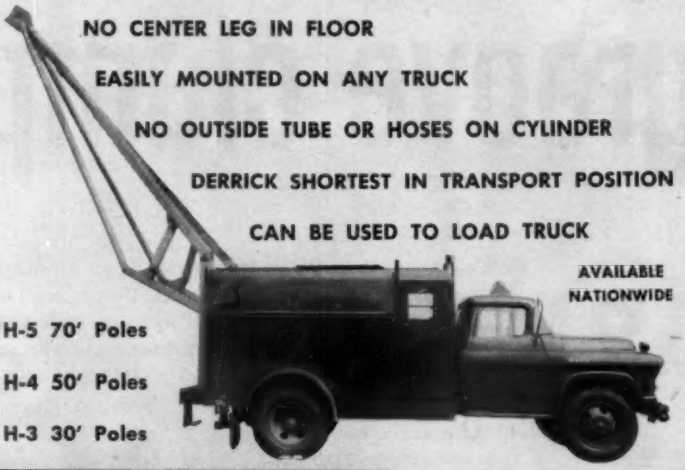
EASILY MOUNTED ON ANY TRUCK

NO OUTSIDE TUBE OR HOSES ON CYLINDER

DERRICK SHORTEST IN TRANSPORT POSITION

CAN BE USED TO LOAD TRUCK

AVAILABLE NATIONWIDE



H-5 70′ Poles

H-4 50′ Poles

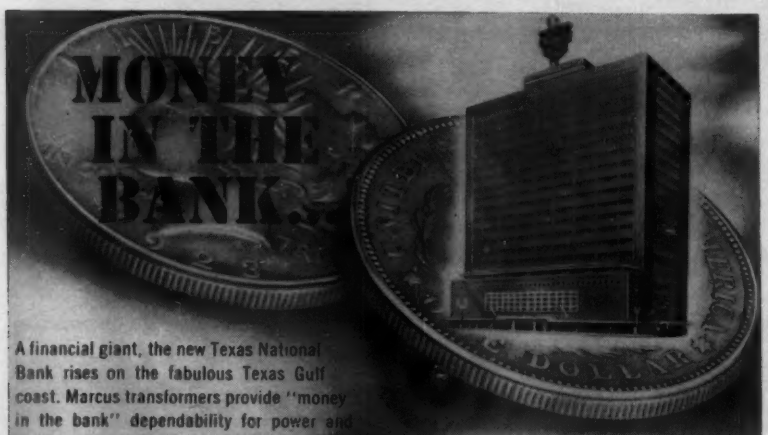
H-3 30′ Poles

AMERICAN TRUCK EQUIPMENT CO.

MANUFACTURERS

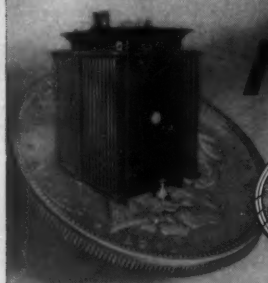
PORTLAND, ORE • OAKLAND, CALIF

HYDRAULIC DERRICKS • ALL ELECTRIC HALL AERIAL LADDERS • UTILITY MAINTENANCE AND CONSTRUCTION BODIES AND HALL HYDRAULIC AND MECHANICAL EARTH BORERS



A financial giant, the new Texas National Bank rises on the fabulous Texas Gulf coast. Marcus transformers provide "money in the bank" dependability for power and lighting distribution. For trouble-free performance and greater profits, choose Marcus for your next transformer installation.

Architect: Kenneth Franzheim, Consulting Engineers: Bernard Johnson & Associates, Electrical Contractor: Howard P. Foley Co.



MARCUS

TRANSFORMER CO., Inc.

RAHWAY, NEW JERSEY

Representatives in Principal Cities

"Mark of Quality"

A COMPLETE LINE OF DRY TYPE AND LIQUID-FILLED TRANSFORMERS THRU 5000 KVA

PERSONAL BRIEFS

(Continued from page 225)

American Institute of Electrical Engineers has elevated these 13 members to the grade of Fellow: **Edward R. Coulbourn,** engineering manager, Alabama Power Co; **Burns N. Gafford,** professor and chairman, department of electrical engineering, University of Texas; **John R. Macintyre,** manager, advance engineering, Measurements Laboratory, General Electric Co; **Charles J. Miller, Jr,** research engineer, Ohio Brass Co; **Albert H. Mittag,** consulting engineer, GE and Fidelity Electric Co; **Kenneth A. Norton,** chief, Radio Propagation Engineering Division, National Bureau of Standards; **Theodore D. Reimers,** inside plant engineer, Consolidated Edison Co of New York; **Edgar W. Robinson,** consultant, Alabama Power; **Ronald J. Rockwell,** vice president and director of engineering, Crosley Broadcasting Corp; **Sebastian L. Scheffer,** senior electrical engineer, Burns & Roe, Inc; **William K. Sonneman,** manager of relay engineering, Westinghouse Electric Corp, **Earl W. Tipton,** section manager, Westinghouse and **Malcolm W. Smith,** head of production and transmission, Ohio Edison Co.

Washington State Public Service Commission has appointed as its new chairman **Don Abel,** former justice of the state supreme court.

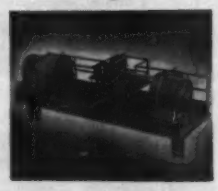
Omaha Public Power District has named **Dewey G. Baker** assistant general manager in charge of sales, employee relations and rural operations, and **Karl M. Joens** assistant general manager in charge of public relations, advertising and public information.

Edward W. Hodgetts, director of promotion, advertising, and publicity, Cincinnati Gas & Electric Co, has been named to the Retail Advisory Board of the newly organized Official Valentine's Day Council, Inc.

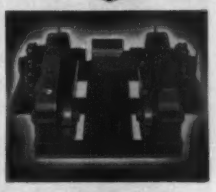
Four Wheel Drive Auto Co has promoted **Victor M. Anderson** to assistant to the vice president-sales and **Fred A. Brown** and **Robert J. Peterson** to assistant sales managers.

Murco POWER DAM GATE HOISTS *for any Size Power Dam*

Murray Gate Hoists are designed and built in a wide range of capacities — from less than one ton to over a hundred tons . . . from the smallest hand operated to the largest motor operated gate hoist.



Back of every MURCO Gate Hoist are over 70 years of designing and building gate hoists.



From this experience we have accumulated designs and patterns that may fit your requirements. In planning power dam gates, we suggest you write us before your plans for the project as a whole are completed . . . it may save expense and important preparation time.

Write for complete information and Engineering Department recommendations.

D. J. MURRAY MANUFACTURING CO.

Manufacturers Since 1883

WAUSAU · WISCONSIN

Westinghouse Electric Corp has appointed **Dr. Clarence Zener** director of the firm's Research Laboratories. Zener previously served as associate director and as acting director . . . New engineering manager of the lamp parts department, Lamp Division, is **Dr. Wilbert A. Taebel.** And **Philip F. Dietz** has been given similar responsibilities in the company's miniature lamp department . . . The Electronic Tube Division recently named **George C. Sziklai** as technical assistant to **R. T. Orth,** vice president and general manager.

Rudolph O. Erickson will become general traffic manager of Anaconda Co on Feb. 1 to replace **Charles A. Butler** who is retiring.

A new manager of manufacturing and a new product section for General Electric Co's power transformer department has been announced. **Philip H. Alspach,** has been named head of the department's manufacturing section. He succeeds **Bruce W. Wyman,** who has been promoted to general manager of the new small-ac-motor and generator department.

Square D Co has made these changes in its engineering department. Two new divisions were created: Design Branch, with **Dr Werner Kussy** as its head, and the Laboratory Branch under **Clifford Jones. Ralph Kingdon** continues as assistant chief engineer. The Design Branch consists of these four sections: switch-gear section directed by **Burdette Holman;** drafting section by **DeForest Butler** as supervisor; drafting training section by **Clement Wolf,** and the general design group which is divided into four teams. These teams work with the above named supervisors on specific assignments. Laboratory Branch is a three part operation consisting of the new products test section under the direction of **Edward Dessert;** existing products test group under **Theodore Wright,** and the production quality follow-up group under **Arne Anderson.**

Allis-Chalmers Manufacturing Co has made these appointments. **W. L. Peterson** and **J. R. Mann** have become managers of the regulator and transformer departments, respectively. In the regulator de-

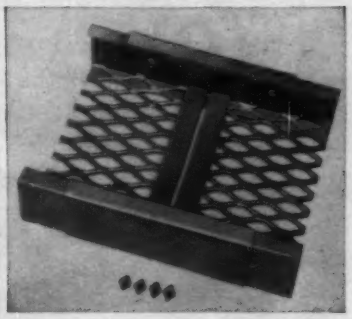
(More Personal Briefs on page 230)

SPECIFY

P-W

for Supporting Cables and Tubing

EXPANDED METAL TROUGH
SOLID METAL TROUGH
LADDER SUPPORTS



P-W provides a strong, versatile and well-grounded system. Channel Connectors with drive rivets are quick and easy to assemble—various lengths and Extension Connectors eliminate field cutting—Adjustable Horizontal and Riser Connectors meet required changes in direction and elevation—supplied in widths from 1" to 24" and lengths from 1' to 16'—Hanger rods or

Twist-Rack

The Structure To Support Tubetrof . . . Cabletrof . . . Shelving . . . Conduit . . . Cables . . . Pipe, Etc.

P-W assists customers in design and job take-off.

Write today for Bulletins

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(Representatives to serve you!)

Signs for Utilities

EASTERN "A" WARNING STANDS

3 Models: Senior 36"
Heavy Duty 27½" Standard 27"
Reflectorized or plain

Lightweight, compact, easy to set up, take down, and store.
Free-swinging sign.
Won't blow over.
SPEED-E-LOK automatically locks stand in open position.

Eastern Metal
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DISTRIBUTORSHIPS AVAILABLE

Identify hazards with EASTERN'S complete line of public utilities safety signs. Widely used by major public utilities throughout the nation. Over 1200 types and sizes of EASTERN safety signs available for prompt delivery. Special designs made to order.

PERSONAL BRIEFS

(Continued from page 229)

partment **R. E. Horn** has been made manager of sales and **R. P. Marohn,** chief design engineer. In the transformer department **L. W. Schoenig** has become manager of sales and **K. P. Wiederkehr** chief design engineer. **G. W. Clothier** has been named manager of the motor and generator department, succeeding **E. E. Ellis,** who has been appointed to the administrative staff of **J. W. McMullen,** vice president and general manager of the Power Equipment Division.

Frederick M. Rutledge has been made manager of project engineering of the Hayes Corp, Michigan City, Ind.

Nordberg Manufacturing Co has appointed **Albert T. Metcalf** as electrical engineer.

V. David Demarest, Jr, has been made sales manager of Peterson Engineering Co, Inc.

James G. Biddle Co has appointed **Philip E. Sellers** an administrative assistant to work with the president and vice president.

Joseph T. Ryerson & Son, Inc, has made these personnel changes: **George E. Handtmann,** assistant to the president and succeeding Handtmann, **Vernon D. Rogers; James E. Dittus,** director of quality; **Rolla R. Ross,** new post of manager of systems and procedures; **George G. Moody,** office manager for the general office; **George H. Blank,** assistant to the general office manager; **Theodore L. Kishbaugh,** assistant vice president in the Procurement Department, and **Wayne D. Dukette,** general manager of the Los Angeles plant.

Appointment of **H. F. Robertson** as manager of technical planning has been announced by the Bakelite Co, a division of Union Carbide & Carbon Corp.

Duff-Norton Co has promoted **Andrew M. Kelly** from manager of Coffing Hoist Division's customer relations department to product manager.

Are you missing something in **Electrical World?**

Right now, have a look at the complete, compact, 2-minute summary of the book, printed on special yellow stock at the front. Here is *the gist* of what's going on in the industry! "Newscope" covers future and late news; "Electrical Week" examines events, generation, distribution, commercial, management, people, manufacturing, and new equipment; "Engineering Trends" briefs *that* aspect of issue content. This specially written summary in the front of each issue, on yellow stock for easy finding, gives you *the complete overall picture of the industry and everything affecting it for the past week!* It mirrors the contents of each issue for absorption almost at a glance – let's you invest your Electrical World reading time more profitably.

Paul M. Brister is new manager of the engineering design section of Babcock & Wilcox Co's manufacturing engineering department. He is replaced as engineering department coordinator by **William D. Stevens.**

Sylvania Electric Products, Inc, has made these personnel changes: **S. George Lawson,** manager in charge of photoflash and incandescent lamp operations, and **Frederick A. Wolfe, Jr,** product sales manager for panelescent lamps of the Lighting Division.

Canadian Westinghouse Co has named **H. N. Muller** chief engineer . . . Westinghouse Electric Corp has appointed **Charles D. Duffy** general traffic manager.

Appointment of **Norman R. Millard** as manager of sales to utilities for Philco Corp's Appliance Division has been announced recently.

Reynolds Metals Co has named **Keith Hall** director of industrial markets.

Mark T. Anthony has been appointed assistant to the vice president and general manager of Kaiser Steel Corp, succeeding **A. F. Scarr,** recently named assistant general manager of Kaiser Center, Inc, Oakland, Calif.

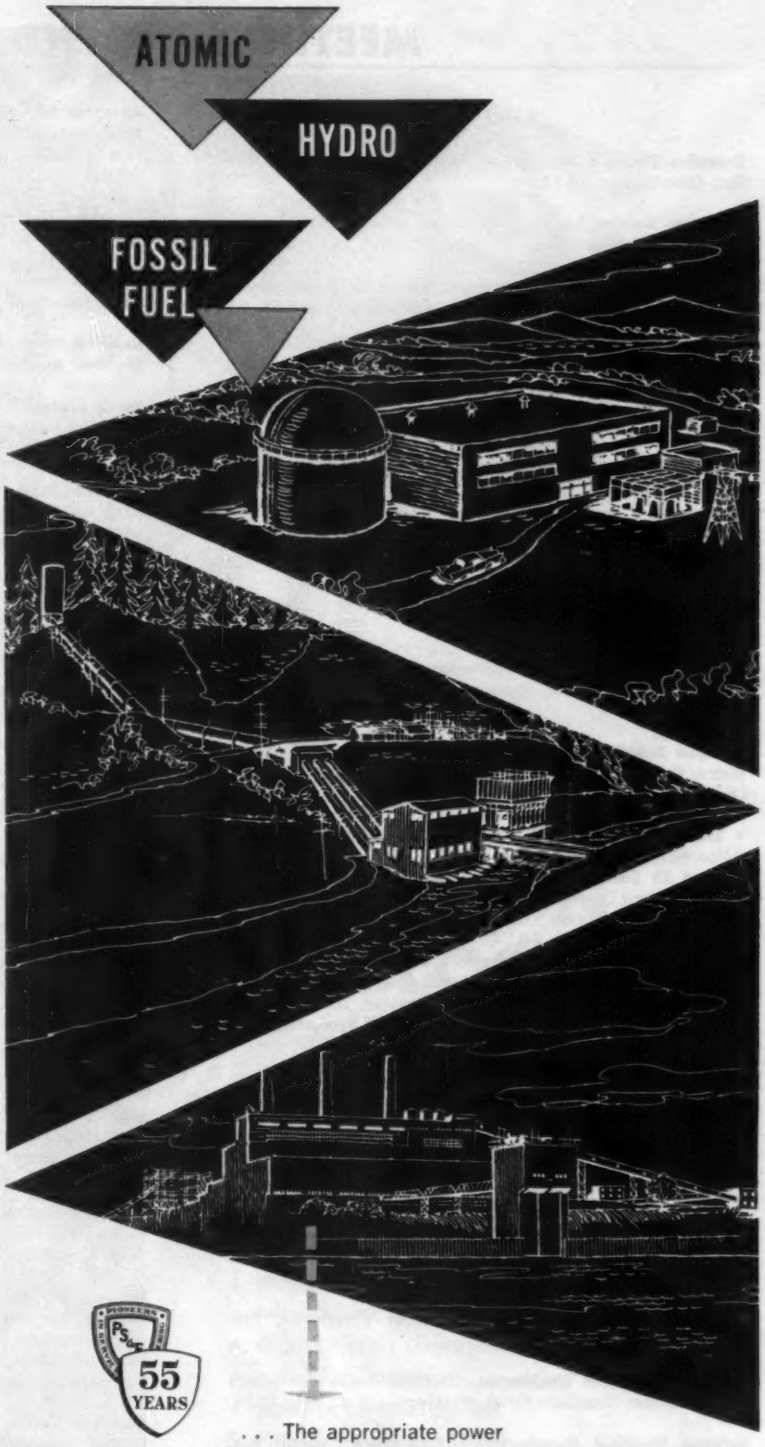
OBITUARY

Grover C. Hubbell, a director and member of the executive committee of Iowa Power & Light Co, died recently after a long illness.

Dr. Erwin F. Lowry, 65, manager of research engineering laboratories of Sylvania Electric Products, Inc, died recently at his Salem, Mass., home. **Dr. Lowry,** a leading authority on lighting, was 1954 recipient of the Gold Medal of the Illuminating Engineering Society.

Howard W. Memmott, industrial sales manager of Connecticut Light & Power Co, died recently of a heart attack.

Bryon A. Winebrener, 61, comptroller of Potomac Edison Co since last June, died after a short illness.



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. . . The appropriate power for your expanding program

Send for our descriptive booklet, "Pioneering New Horizons" of these and other services.

Pioneer Service & Engineering Co.
231 South La Salle Street • Chicago, Illinois

MEETINGS CALENDAR

JANUARY

Canadian Electrical Association—Eastern Zone Meetings, Quebec, Canada, Jan. 28-31.

American Welding Society—3rd Annual Midwest Welding Conference, Illinois Tech Chemistry Bldg., Chicago, Ill., Jan. 30-31.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, Hotel President, Kansas City, Mo., Jan. 31-Feb. 1.

Pennsylvania Electric Association—Transmission & Distribution Committee, Penn Harris Hotel, Harrisburg, Pa., Jan. 31- Feb. 1; Hydraulic Power Committee, Brunswick Hotel, Lancaster, Pa., Jan. 31-Feb. 1.

Edwin L. Weigand Co—Electric Heating Workshop, Pittsburgh, Pa., Jan. 31-Feb. 1.

• **Great Lakes Power Club**—Winter Meeting, Chicago, Ill., Jan. 31-Feb. 1.

FEBRUARY

Ninth Annual Industrial Engineering Institute—University of California, simultaneous sessions in Berkeley and Los Angeles, Calif., Feb. 1-2.

National Association of Purchasing Agents—26th Annual Mid-Winter Conference, Public Utility Buyers' Group, Brown Hotel, Louisville, Ky., February 3-5.

• **Edison Electric Institute**—Prime Movers Committee, Deschler Hilton Hotel, Columbus, Ohio, Feb. 4-6; Electrical Space Heating and Air Conditioning Committee, St. Louis, Mo., Feb. 6-8; Street Lighting Committee, Washington, D. C., Feb. 6-7; Transmission & Distribution Committee, Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 7-8; Electrical System & Equipment Committee, Somerset Hotel, Boston, Mass., Feb. 11-12; Residential Lighting Committee, Cincinnati, Ohio, Feb. 11-13; Commercial Cooking & Water Heating Committee, Tutwiler Hotel, Birmingham, Alabama, Feb. 14-15; Residential Promotion Committee, New York, N. Y., Feb. 14-15.

American Society for Testing Materials—Annual Committee Week and Spring Meeting, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 4-8.

Pennsylvania Electric Association—Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 7-8; Communications Committee, Hotel Americus, Allentown, Pa., Feb. 11-12; System Planning Committee and Systems Operation Committee, Benjamin Franklin Hotel, Feb. 14-15; Relay Committee, Roosevelt Hotel, Pittsburgh, Pa., Feb. 28-Mar. 1.

National Electrical Week—Second Annual Observance, Feb. 10-16.

Electric Institute of Washington—Electrical Trade Conference and Exposition, Shoreham Hotel, Washington, D. C., Feb. 12-14.

National Electrical Manufacturers Association—General Purpose Control Subcommittee, Advisory Committee, Industrial Control Section and Industry Control Subcommittee, Advisory Committee, Industrial Control Section, Feb. 13; Electronic Control Subcommittee, Advisory Committee, Industrial Control Section and Standards Committee, Advisory Committee, Industrial Control Section, Feb. 14—all being held at NEMA Headquarters, 155 East 44th St., New York, N. Y.

American Public Power Association—First Engineering and Operations Workshop, Springfield, Mo., Feb. 14-15.

American Institute of Electrical Engineers—1957 Transistor & Solid State Circuits Conference, sponsored jointly with Institute of Radio Engineers and University of Pennsylvania, Philadelphia, Pa., Feb. 14-15.

Cleveland Electronics Conference—Masonic Auditorium, Cleveland, Ohio, Feb. 15-16.

National Society of Professional Engineers—Spring Meeting, Hotel Francis Marion, Charleston, S. C., Feb. 15-16.

National Adequate Wiring Conference—13th Annual Discussion, Sherman Hotel, Chicago, Ill., Feb. 21-22.

North Central Electrical League—20th Annual Upper Midwest Electrical Industry Convention, Leamington Hotel, Minneapolis, Minn., Feb. 24-27.

American Society of Heating and Air-Conditioning Engineers—63rd Annual Meeting, Chicago, Ill., Feb. 25-28; 13th International Heating and Air-Conditioning Exposition, Chicago, Ill., Feb. 25-Mar. 1.

Institute of Radio Engineers—Western Joint Computer Conference, Hotel Statler, Los Angeles, Calif., Feb. 26-28.

Electrical Equipment Representatives Association—Annual Meeting, St. Anthony Hotel, San Antonio, Tex., Feb. 27-Mar. 2.

Pacific Coast Electrical Association—Business Development Section, Sheraton-Palace Hotel, San Francisco, Calif., Feb. 28-Mar. 1.

MARCH

Southern Safety Conference—John Marshall Hotel, Richmond, Va., Mar. 3-5.

• **National Rural Electric Cooperative Association**—Annual Meeting, Conrad Hilton Hotel, Chicago, Ill., Mar. 4-7.

Louisiana State University—Annual Conference on High-Speed Computers, Baton Rouge, La., Mar. 5-8.

• **Street Tree and Utility Conference**—Hotel Cleveland, Cleveland, Ohio, Mar. 7-8.

Engineers Joint Council—2nd Nuclear Engineering and Science Conference; 3rd International Atomic Exposition, and 5th Hot Laboratories and Equipment Conference, Convention Hall, Philadelphia, Pa., Mar. 11-15.

Electric Companies Public Information Program—Inter-Regional Committee, New York, Mar. 12; Steering Committee, New York, Mar. 14.

National Electrical Manufacturers Association—General Engineering Committee, Switch and Enclosed Breaker Section, Chase Hotel, St. Louis, Mo., Mar. 13; Panelboard and Distribution Board Section, Molded Case Breaker Section and Busway Section, Chase Hotel, St. Louis, Mo., Mar. 14.

American Society of Mechanical Engineers—Gas Turbine Conference, Sheraton-Cadillac Hotel, Detroit, Mich., Mar. 18-21; Engineering Management Conference, William Penn Hotel, Pittsburgh, Pa., Mar. 27-28.

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, Mar. 21.

• **Oklahoma Utilities Association**—Annual Convention, Hotel Tulsa, Tulsa, Oklahoma, Mar. 28-29.

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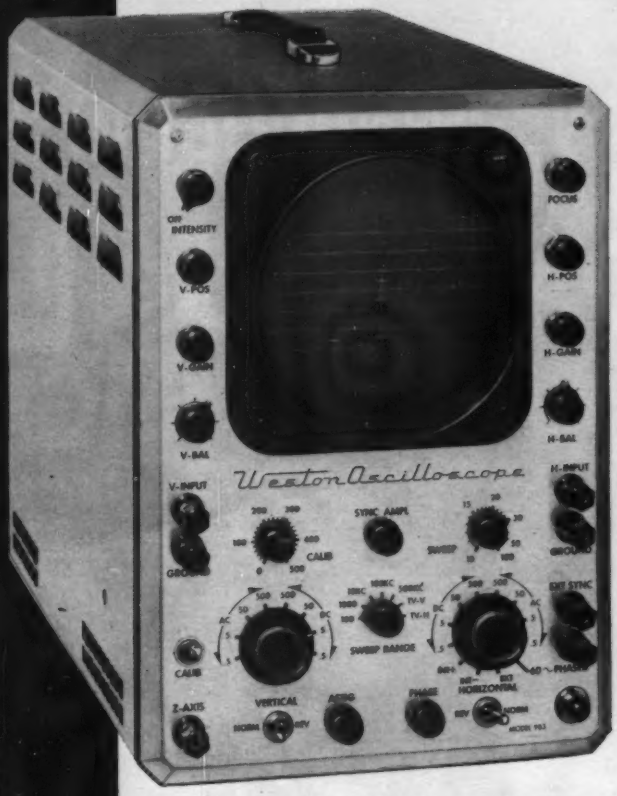

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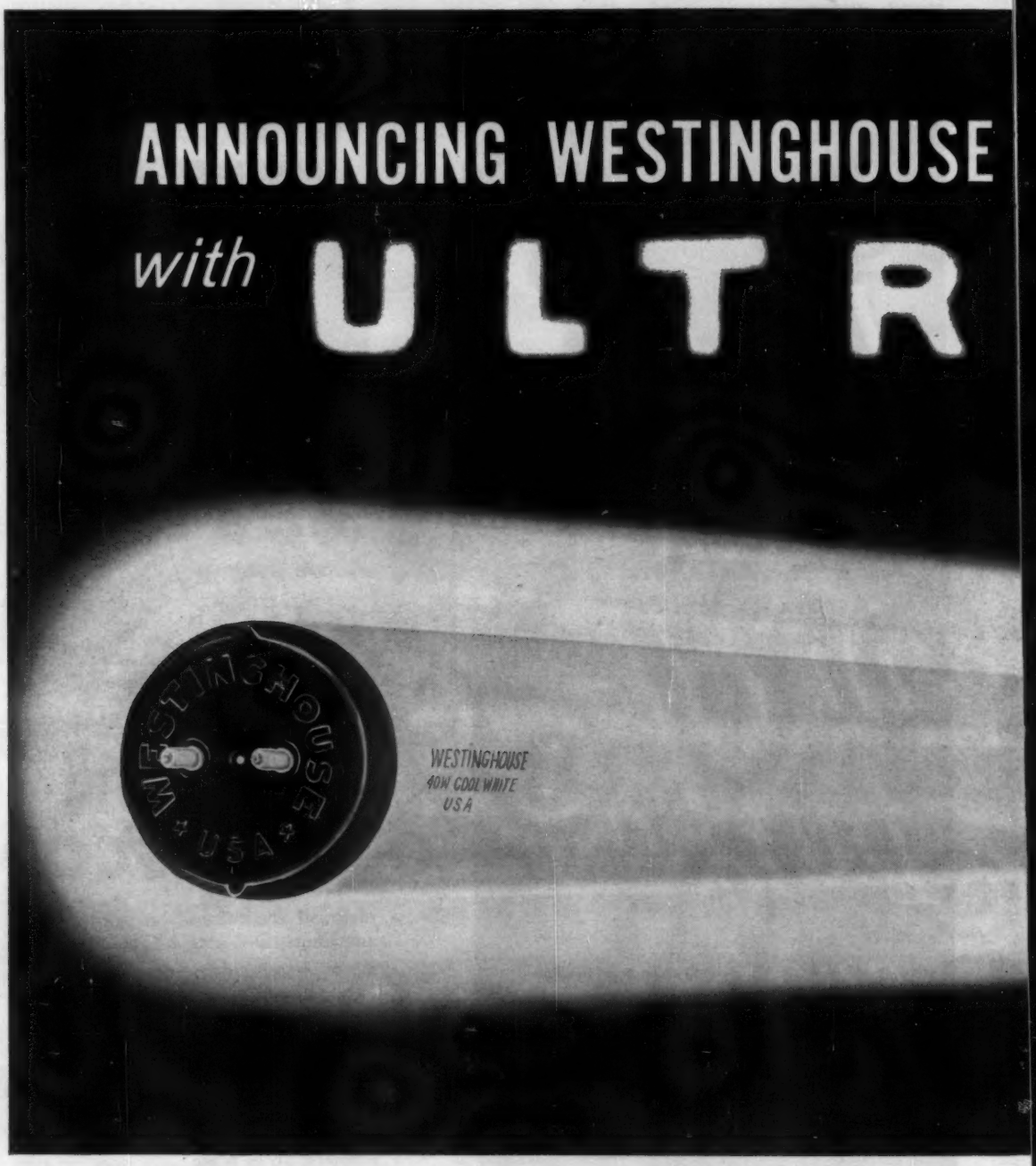

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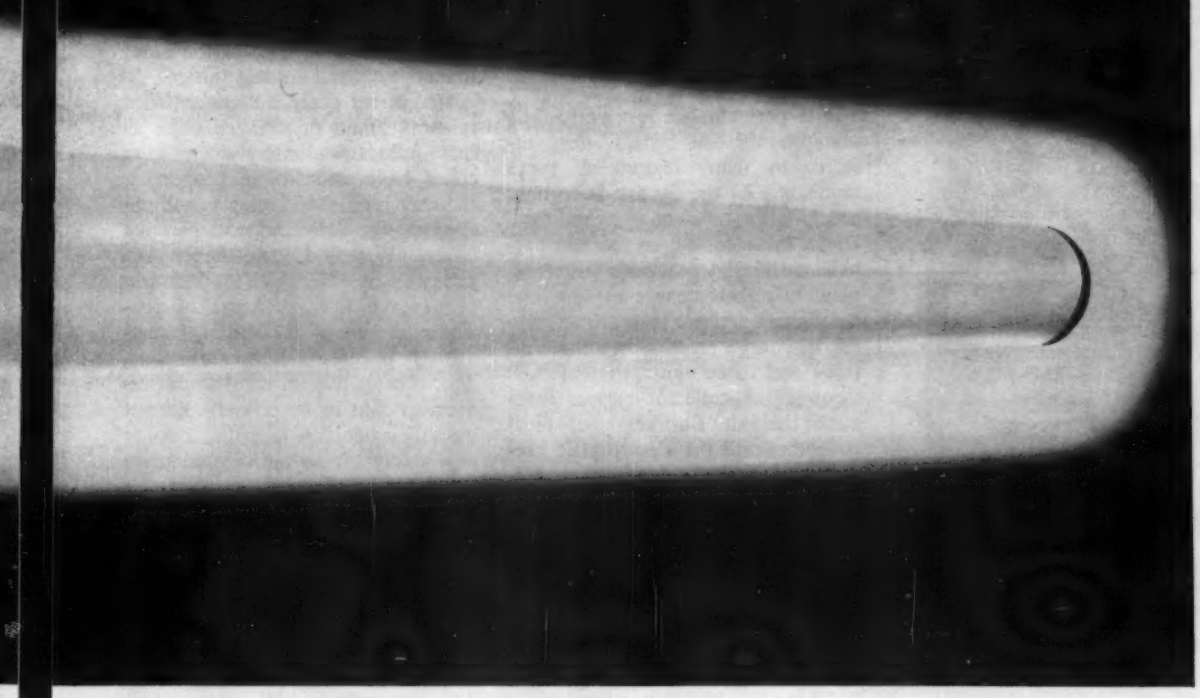

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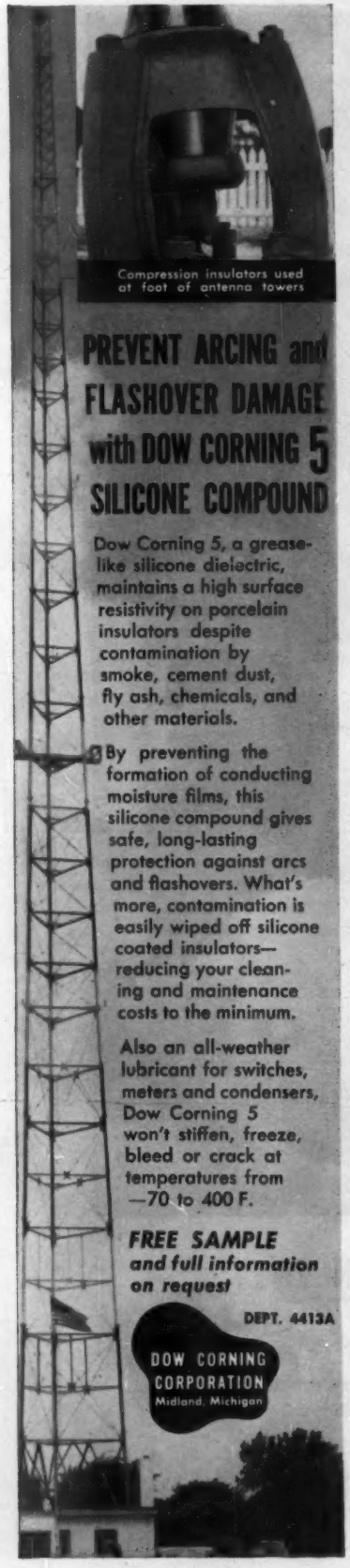
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Fluid Coke Burns

(*Continued from page* 114)

Essex Generating Station of Public Service Electric & Gas Co. This table is intended primarily to indicate calorific value of the flue dust and particle size of dust in the flue gases leaving the boiler with varying percentages of coke being burned and with varying fineness of fluid coke pulverization. The tests on Boiler No. 1 showed that the combined efficiency of the precipitators at full boiler load varied from 77% with 4 tons per hr to 36% with 18 tons per hr. The efficiency when the boiler was operating at half load was considerably higher.

Table IV gives the test results for the mechanical collector installed with the Riley boiler at Blaine Island Plant of Carbide & Carbon Chemicals Corp. During this test, fly ash was reinjected in the furnace. Collector efficiency was determined to be about 90%.

The performance of electrostatic precipitators can be adversely affected by many factors. If more than 20% of the fly ash is carbon, precipitator efficiency is reduced. Under these conditions, carbon particles striking a grounded collecting plate lose their charge rapidly and completely and are then attracted to the discharge electrodes, reprecipitated and so on, until the gas flow through the collector carries them out of the unit. Both the mechanical collectors and the electrostatic precipitators show a decrease in efficiency at very low collector inlet dust loadings of about 0.8 grains per cu ft.

It appears, perhaps, that mechanical fly-ash collectors may be better.

U. S. capacity to produce fluid coke is 10,000 tons per stream day or about 3,330,000 short tons per yr. Of this amount, in 1955, about 43% was for non-fuel uses, 34% was exported, and only 23% (765,000 tons per year) was used as fuel. As additional units are installed, more coke is expected to be available as fuel, but the total amount will be insignificant compared to the amount of coal, gas, and oil used in the production of electric energy.

It appears doubtful that petroleum coke will be generally used by utility companies as a fuel. It is reasonable to expect, however, that coke will be burned by utility company plants close to refineries with coking units. This arrangement is in operation in several places. In California, Pacific Gas & Electric Co's Oleum Plant burns coke from the Union Oil Co. Delaware Power & Light Co's Delaware City Power Station will burn fluid coke from the Tidewater Associated Oil Co refinery. Virginia Electric & Power Co's Yorktown Station will burn delayed coke from the American Oil Co refinery.

It also appears doubtful that all refiners will cease to produce heavy or high viscosity fuel oils and produce only petroleum coke. Coking units are usually installed to obtain increased yields of the lighter fractions when Bunker "C" prices are low or decreasing. Were many refineries to cease production of Bunker "C", its price would increase to a point at which there would be no incentive for the other refiners to install coking units.

At present, there is no established price for fluid or delayed coke as fuel. Because many petroleum cokes have undesirable properties, such as high sulfur and vanadium content, the delivered cost of coke to a utility should be no higher than the costs of other fuels and should perhaps be lower because of possible differences in capital investment required and operating costs. The prospective buyer should remember that many refiners did not base their decision to install a coker unit solely on an anticipated price for the coke.

READERS FORUM

R/W Issue All Right

To the Editor:

Your article on "Right-of-Way and Site Study" as written in the Jan. 7, issue, is certainly a most complete "roundup" of the problems we in the utility business are encountering.

I want to take this opportnity of offering my congratulations to your staff for a job so well done.

F. J. Hitchen
Assistant to Executive Vice President
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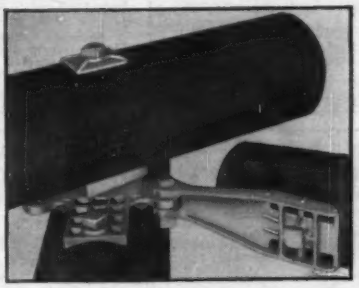

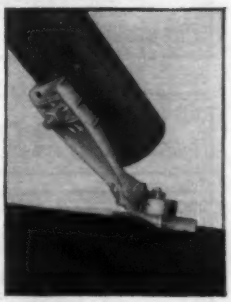

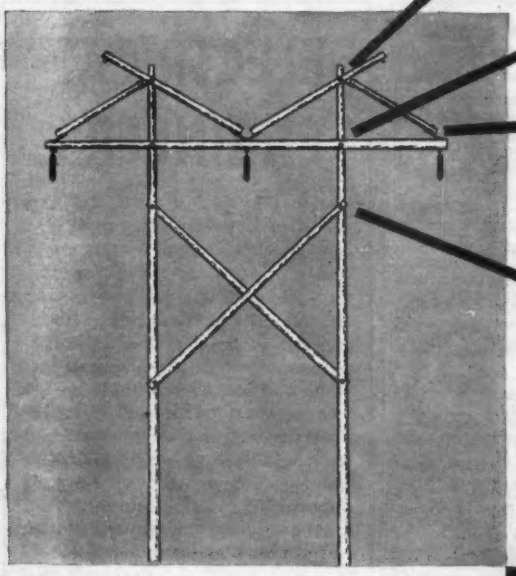

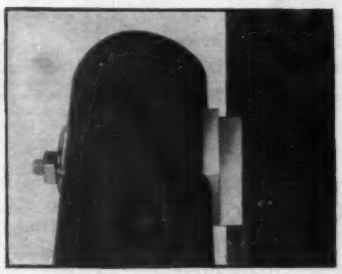

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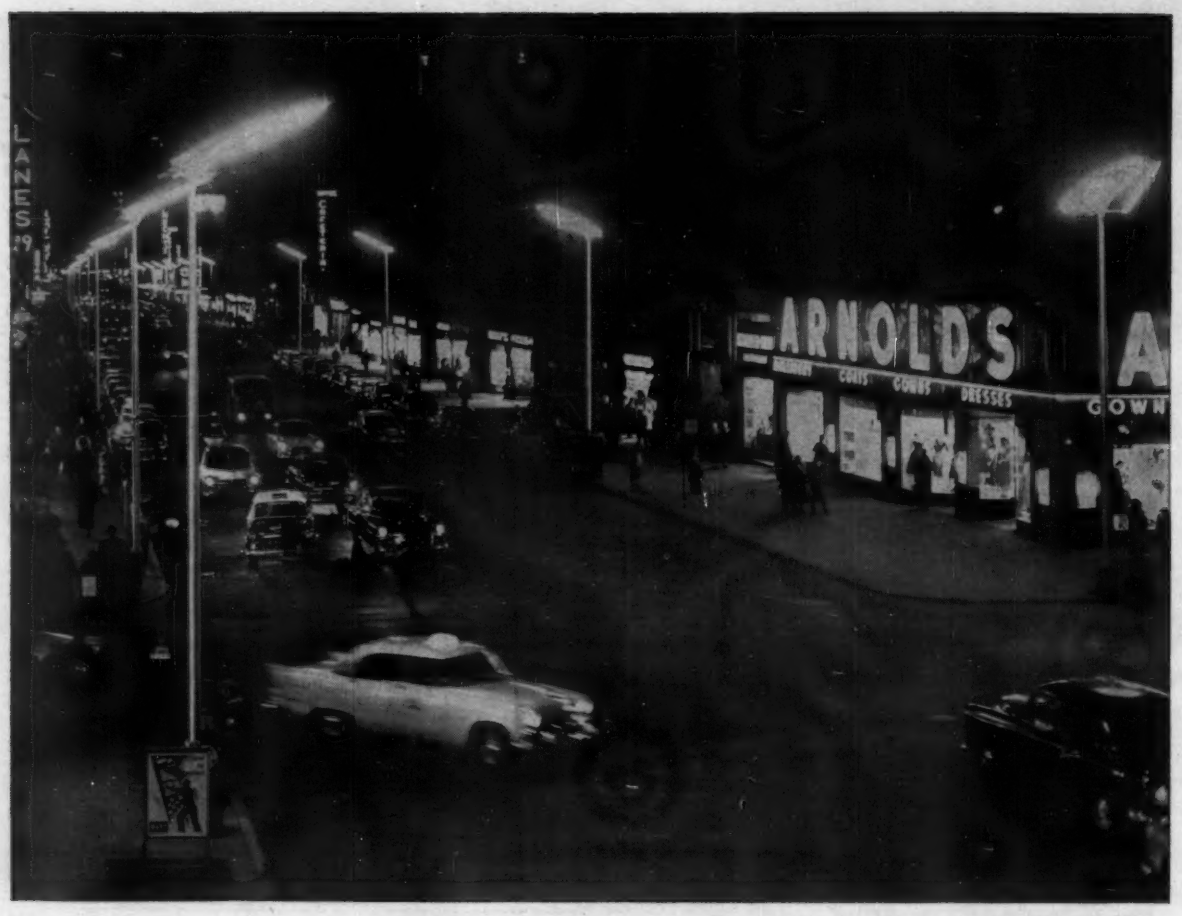

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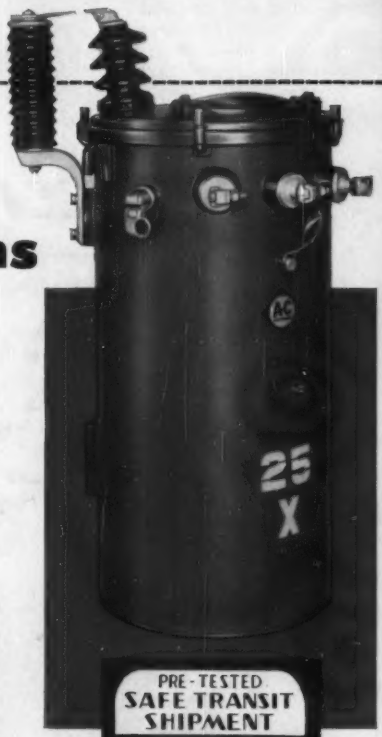
Quality Control at Allis-Chalmers



Simulating Transportation Conditions Puts Transformers in Ship Shape

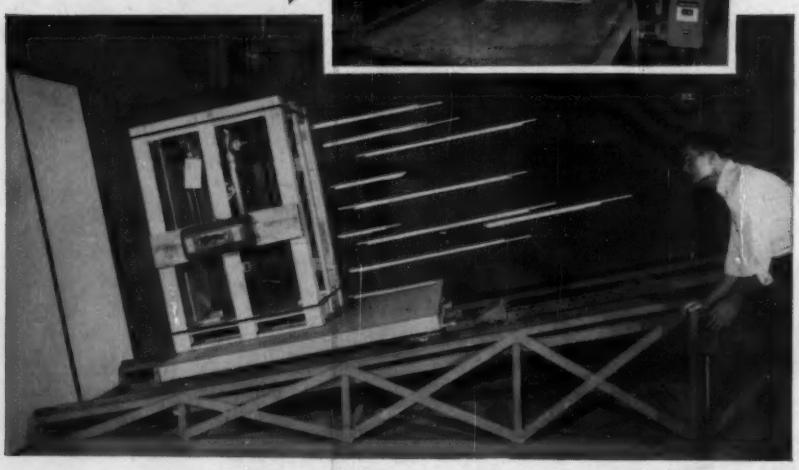
Pretesting crate design is your assurance that transportation rigors will not affect transformer performance. Road conditions simulated on new shock-test equipment not only provide information on safe crating but produce data used in improving transformer design.

From material acceptance tests through an obstacle course of in-plant inspection to pretesting crate design — Allis-Chalmers quality control doesn't end until the transformer arrives at your door. For the complete story, get Bulletin 61B8355. Contact your Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

PRE-TESTED
SAFE TRANSIT SHIPMENT
This PACKAGED PRODUCT meets the pre-testing standards established by the National Safe Transit Committee and will withstand ORDINARY transportation and handling hazards
NATIONAL SAFE TRANSIT COMMITTEE
MAKE SAFE HANDLING YOUR JOB!

Look for this seal on Allis-Chalmers transformer shipments. It certifies approval by the National Safe Transit Committee.

Vibration — This vibrating table duplicates railroad car and truck conditions. It simulates varying speeds, irregularities in road or track, action of truck springs.



Shock — Crated unit slides down incline to produce impact of many times the acceleration of gravity force. Shock recorder on crate measures initial impact, simulating sudden stops during shipment.

ALLIS-CHALMERS

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